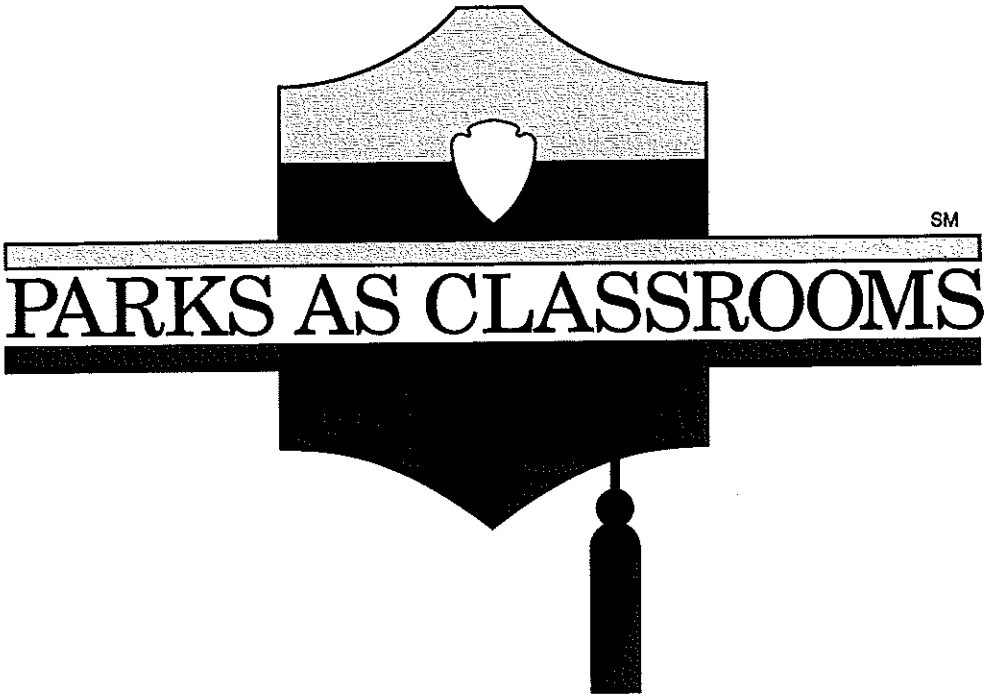

GULF ISLANDS

NATIONAL SEASHORE

FOURTH GRADE ACTIVITY GUIDE

FOR TEACHERS

PARK ADDRESSES

Gulf Islands National Seashore comprises more than 12,000 acres of land and over 80,000 acres of submerged land. The park includes eleven separate units stretching eastward 150 miles from West Ship Island, Mississippi to the eastern tip of Santa Rosa Island in Florida. The Mississippi and Florida districts maintain administrative headquarters and four visitor centers. For more information, or to order additional copies of this guide, please contact:

Superintendent
Gulf Islands National Seashore
3500 Park Road
Ocean Springs, Mississippi 39564

(228) 875-0074

or

Superintendent
Gulf Islands National Seashore
1801 Gulf Breeze Parkway
Gulf Breeze, FL 32563

(850) 934-2600

or visit our website
www.nps.gov/guis

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FOREWORD

Gulf Islands National Seashore was established in 1971 to protect a constantly moving string of barrier islands located in Florida and Mississippi. Over 150 miles of shoreline offer wide, gently sloping beaches of fine sand and clear, blue-green water. Equally important as the beautiful beaches are the natural and cultural resources of the Seashore, including two wilderness islands, an excellent collection of coastal military fortifications, and thousands of wild plants and animals that are dependent upon the coastal marine environment.

Gulf Islands National Seashore is truly in the "front yard" of many of the coastal cities and schools in the northern Gulf of Mexico. As communities enlarge, the potential for direct and indirect effects on lands and waters within the Seashore becomes more significant. In order to meet out mission of preserving park areas for their natural, cultural, and recreational values, Gulf Islands National Seashore needs the assistance of all park neighbors and visitors.

One of the best ways to meet this goal is to enlighten young people who live close-by about the rich cultural and natural resources of Gulf Islands National Seashore. Ralph Waldo Emerson wrote, "Truly speaking, it is not instruction by provocation that I receive from another soul." The lessons in this activity guide are designed to educate and provoke the interests and concerns of students.

Whether you bring your students to Gulf Islands National Seashore or complete the following activities at school, the idea of **Parks as Classrooms** is fitting. What better place to learn than your own front yard.

Jerry A. Eubanks
Gulf Islands National Seashore
Superintendent

ACKNOWLEDGEMENTS

This activity guide was researched, designed, and written, and prepared for publication by Debbie Kanze, working as a contractor for the National Park Service. Her interest and enthusiasm for Gulf Islands National Seashore, and for the environment in general, can be seen in the pages that follow.

While research the background material used in the lesson, technical support and expertise were provided by the following present and former staff at Gulf Islands National Seashore: Mary Jones (former Chief of Interpretation), Doug Hunt, Liz Cox, Ed Kanze, Jeff Parsons, David Ogden, H. O. Simpson, Larry Lisco, Mike Hobbs, Gary Hopkins, John Weller, Mark Lewis, Peter Jordan, Jill Kinney, Todd Clark, and Francine Ware. Other important information was generously provided by Richard Heard of the University of Southern Mississippi's Institute for Marine Sciences, Dave Ruple of the Nature Conservancy, Mary Adkinson of the Biloxi (MS) Library, and Gordon Cotton of the Old Court House Museum in Vicksburg, Mississippi.

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The following individuals added artistic flair to the project: Pat Bernstein, who designed the cover and Mark Grace, who contributed his fine drawings, maps, and diagrams.

Parks as Classroom is an education initiative of the National Park Service in partnership with the National Park Foundation. Support is provided by the National Park Foundation, which makes grants and seeks out corporate partnerships.

Gail Bishop
Chief of Interpretation
Gulf Islands National Seashore

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INTRODUCTION

Gulf Islands National Seashore is filled with important natural and historic resources. Our country's largest national seashore comprises barrier islands, forests, marshes, nineteenth century forts and batteries, plus archeological sites. The islands are surrounded by magnificent blue waters and are covered with snow-white sands. Along the mainland the islands provide barriers protecting fragile ecosystems from waves and storms. The forest and marshes are filled with an abundance of wildlife. Alligators, herons, and egrets can be seen hunting along the waterways throughout the park. Nature trails wind through pine, magnolia, and live oak forests. Boardwalks and footpaths lead through marshes and dunes on barrier islands. Forts and batteries are remnants of coastal defense systems that were once active along the Gulf. These brick and concrete structures echo back to a time when our shores needed protection from invasion of foreign enemies.

The Parks As Classrooms program was established to "utilize the abundant natural, cultural, historical, and human resources of the National Parks to instill a sense of wonder and curiosity in young people, and to desire to participate in the life-long learning process for everyone." This activity guide was created to further this mission and to inspire teachers and students to seek out the many educational opportunities Gulf Islands National Seashore has to offer.

The activities in this guide were written for use in conjunction with elementary school for the fourth grade level in Florida and Mississippi. The lessons are structured to provide information necessary to understand and teach each topic. The activities are designed as building blocks to stimulate ideas. Expand and modify the lessons as needed to suit the interests and abilities of your students.

This guide emphasizes the positive. Focusing on the positive aspects of our world--to learn about the fascinating resources we have, how to become good stewards for protection, and what we can do to help--is one way to spark interest. Enthusiasm is contagious and even a little bit of knowledge can develop into a life-long pursuit of nature, history, and conservation.

Enjoy the activity guide. It was created to make learning fun. Outdoor activities were added for field trips to Gulf Islands National Seashore. Come visit Gulf Islands National Seashore and let your students "experience their America."

UNIT OVERVIEW

This activity guide has been organized into six units. Each unit contains from five to fourteen individual activities. Most of the lessons were written for use in the classroom, but several require time outdoors. This is mentioned in the "Location" section of each activity. The "Subject" listed is the dominant topic, or theme, for each activity. Activities may cover more than one topic, and many can be slightly modified to address a different topic. The amount of time listed for each activity is an average. It may be increased or decreased as desired. Some of the activities are interrelated to each other, and these are designated in the "Related Activities" section.

UNIT I -- SEASHORE STEWARDSHIP

This unit contains general information about Gulf Islands National Seashore. Why National Parks are created, the stewardship and protection of resources, different park habitats, vocabulary words, and marine debris are discussed.

UNIT II -- THE SANDS OF TIME

This unit contains information on the formation of islands and on seashores in general. It delves into the forces of nature that allow these places to exist and those that may take these places away. Seashore inhabitants and plants are discussed.

UNIT III -- THE VALUABLE SALT MARSH

This unit highlights the importance of the salt marsh and teaches how all life is interconnected. Food chains and food webs are introduced. Plants and animals of the marsh are discussed. The lessons explain the reasons why marshes are so valuable.

UNIT IV -- SEASHORE CELEBRITIES

This unit explores the natural history of Gulf Islands National Seashore. Many creatures, common and uncommon, are profiled. Animal adaptations, behaviors, and relationships are discussed.

UNIT V -- WATER, WATER, EVERYWHERE

This unit emphasizes the water cycle and the atmosphere, and how people are influenced by them. Bodies of water, tides, global warming, and weather are discussed.

UNIT OVERVIEW

UNIT VI -- CROSSROADS TO THE GULF

This unit focuses on Gulf Coast prehistory, recent history, technological advances, and social growth. Native Americans, explorers, forts, lighthouses, and cultural interactions are discussed.

APPENDIX A -- ADDITIONAL ACTIVITIES

This unit contains activities that can be linked to other lessons and also used individually. Recycling, wildlife, and building a weather station are featured.

APPENDIX B -- BROCHURES AND MAPS

This section includes brochures provided by Gulf Islands National Seashore, The National Marine Fisheries Service, The Gulf Coast Research Lab, and others. State maps for Florida and Mississippi are also included. Information in the brochures covers such topics as historical forts, plants, animals, and outdoor safety.

APPENDIX C -- PARK ACTIVITIES

This section includes activities that can be used during a field trip to Gulf Islands National Seashore. I.S.L.A.N.D. is for use when visiting West Ship Island. M.A.R.S.H. can be used when visiting Davis Bayou, or adapted for Naval Live Oaks.

GLOSSARY

The glossary contains words that appear frequently throughout the activity guide. All unusual words are defined at the time they are used. The glossary is not intended to be comprehensive, but it does include many plants and animals discussed in the text.

ACTIVITY SOURCES

For teachers interested in learning more about the topics explored in this guide, this section lists periodicals, environmental education books, and training courses.

BIBLIOGRAPHY

This section contains a list of all reference books used in writing this guide.

LOCATING GULF ISLANDS NATIONAL SEASHORE

Subject: Geography
Duration: 1 hour
Location: Classroom
Related Activities: What if There Wasn't a National Seashore

Objectives:

Students will learn to locate Gulf Islands National Seashore on: a map of the United States, a map of Mississippi, and a map of Florida. Discuss with students: Park boundaries, their relationship to the Gulf of Mexico, the barrier islands, surrounding towns, major rivers, and other bodies of water located in and around the Park.

Materials:

* Map of United States
* State map of Florida
* State map of Mississippi
* Gulf Islands National Seashore brochure
* Pencils
* Paper
* 2 transparency sheets

Method:

After discussion, students will identify Gulf Islands National Seashore by drawing their own maps of the park mainland, islands, adjacent bodies of water, rivers, and nearby towns. Students will also determine what route they would have to take to get to Gulf Islands National Seashore from their school or home.

Background:

Gulf Islands National Seashore was formed in 1971 to protect barrier islands in the Gulf of Mexico from development, and to preserve the historic structures located on the islands and mainland. Two of these barrier islands, Horn and Petit Bois, are federally designated wilderness areas. Ship Island was used as the first federal quarantine station, and today its beaches are accessible to visitors via a passenger ferry. The mainland portion of the Mississippi district was originally Magnolia State Park. Today it is home to the Mississippi headquarters and is called Davis Bayou. The mainland area of the Florida district was the first federal tree farm established in the United States. It is called Naval Live Oaks, and today it is the location of the Florida headquarters. Visitors' centers, nature trails, and other amenities are spread throughout the Park. The forts and batteries maintained by the Park show the evolution of coastal defense spanning a period of over one hundred years of history. Santa Rosa Island in Florida is host to many of these structures. Brochures in Appendix B explain in more detail about these historic treasures.

LOCATING GULF ISLANDS NATIONAL SEASHORE

Suggested Procedure:

1. Using the map of the United States, have students identify the Florida Gulf Coast, the Mississippi Gulf Coast, and Gulf Islands National Seashore.

2. Using the state map of Florida and the Gulf Islands National Seashore brochure, have the students identify the location of: Gulf Breeze, Naval Live Oaks (Florida Headquarters), Pensacola, Perdido Key, Santa Rosa Island, and the surrounding bodies of water.

3. Using the state map of Mississippi and the Gulf Islands National Seashore brochure, have the students identify the location of: Biloxi, Ocean Springs, Davis Bayou (Mississippi Headquarters), Petit Bois Island, Horn Island, East Ship Island, West Ship Island, and the surrounding bodies of water.

4. Identify the location of the school on one of the state maps. Discuss the location of Gulf Islands National Seashore relative to the location of the school. Which part of the park is closest to the school? What route would be taken to reach the park?

5. Copy the following maps onto transparencies for projection. Show the students the different parts of the Park, both on the mainland and the islands. What major rivers flow into the bays and eventually feed the Gulf?

6. Leaving one of the transparencies projected, have students draw their own maps of Gulf Islands National Seashore, on the Florida and/or the Mississippi Gulf Coasts. Put the state maps out so the students can use them for reference. Have them identify any or all of the following on their maps, and when completed, discuss the maps with the students.

<u>Bodies of Water</u>
Gulf of Mexico
Mississippi Sound
Pensacola Bay
Perdido Bay
Santa Rosa Sound

<u>Towns</u>
Biloxi, MS
Gulf Breeze, FL
Ocean Springs, MS
Pascagoula, MS
Pensacola, FL

<u>Mainland</u>
Davis Bayou, MS
Naval Live Oaks, FL

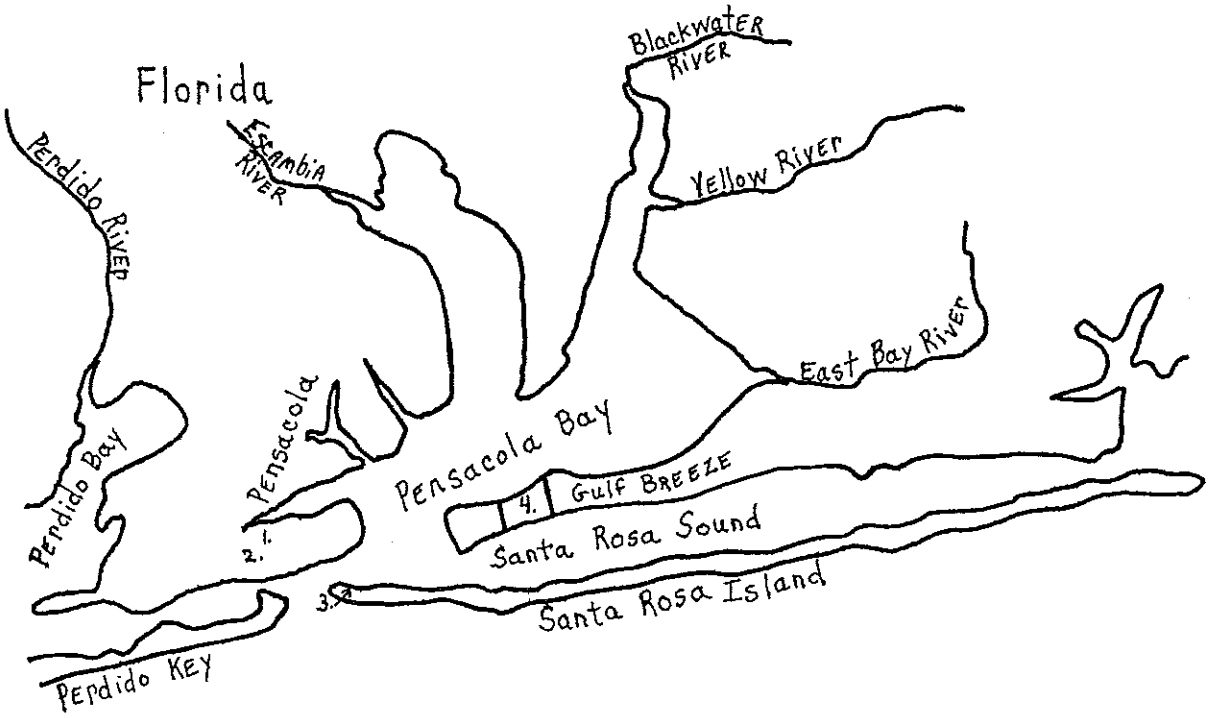
<u>Rivers</u>
Biloxi River, MS
Blackwater River, FL
East Bay River, FL
Escambia River, FL
Escatawpa River, MS
Pascagoula River, MS
Pearl River, MS
Yellow River, FL

<u>Islands</u>
East Ship, MS
Horn, MS
Perdido Key, FL
Petit Bois, MS
Santa Rosa, FL
West Ship, MS

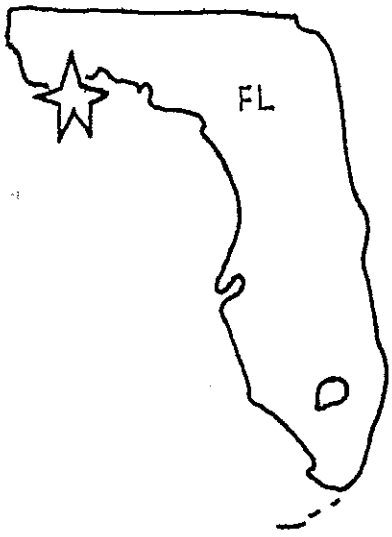
<u>Forts</u>
Advanced Redoubt, FL
Barrancas, FL
Massachusetts, MS
Pickens, FL

7. Have any of the students (or the teacher) ever been to Gulf Islands National Seashore?

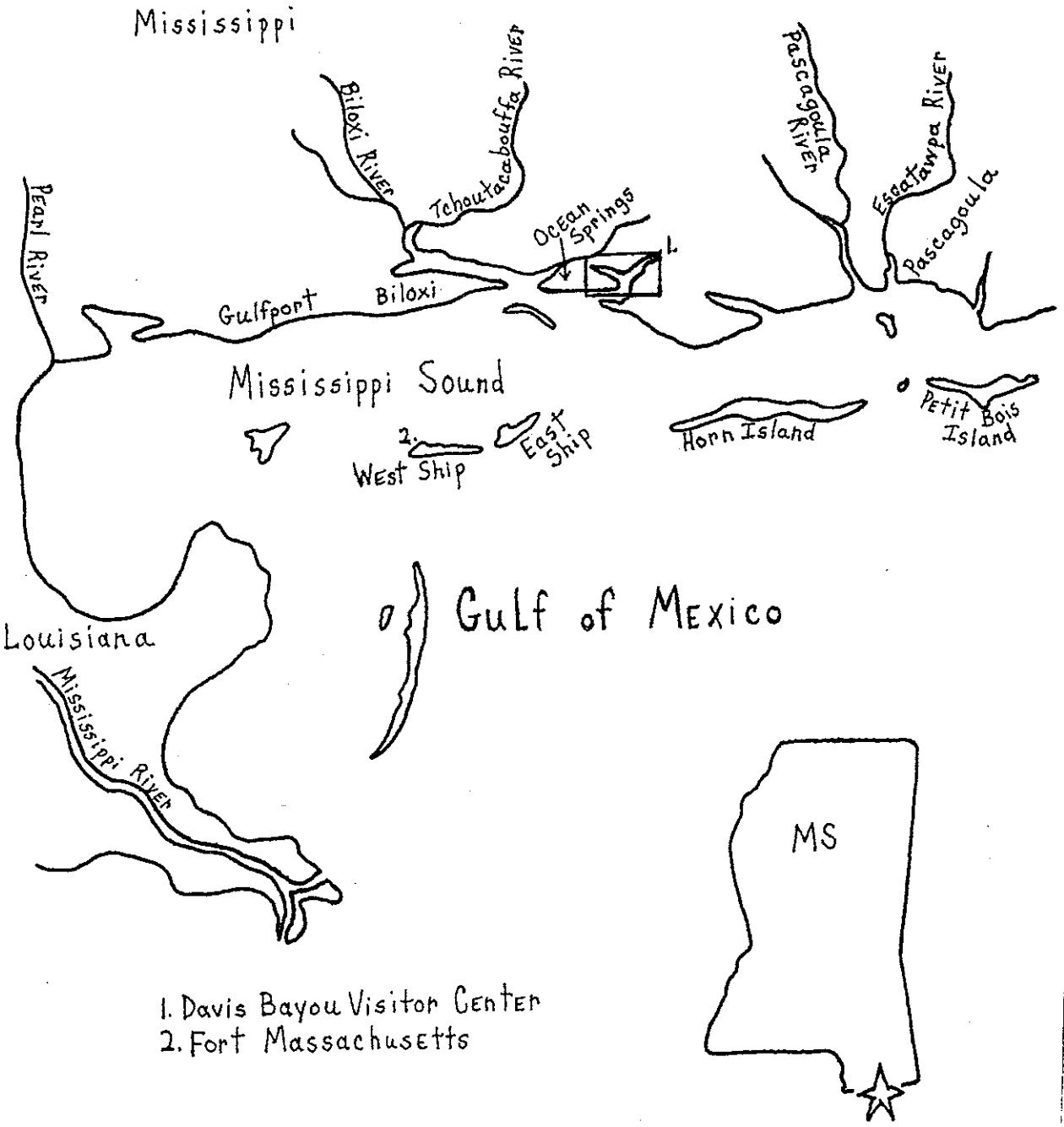
MAP OF THE FLORIDA GULF COAST



1. Advanced Redoubt
2. Fort Barrancas
3. Fort Pickens
4. Naval Live Oaks



MAP OF THE MISSISSIPPI GULF COAST



HABITAT CARDS

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: What if There Wasn't a National Seashore

Objectives:

To learn what a habitat is, and to understand the things that animals require to survive. To understand why it is important to protect habitats so that all plants and animals (including people) will have a place to live and prosper.

Materials:

* Index cards
* Magic markers

Note: index cards need to be prepared in advance.

Method:

By playing "Habitat Cards," students will learn about different habitats and their residents at Gulf Islands National Seashore.

Background:

The habitats found at Gulf Islands National Seashore range from wetland areas such as fresh and salt marshes to dry areas such as dunes. A wide variety of animals use these different habitats for food, shelter, and rearing their young. A salt marsh is an area that is tidal, and is fed by both fresh water (from rain and rivers) and salt water (from oceans). It supports a vast amount of sea-life by producing nutrients and providing shelter. It also acts as a filter, purifying (to some extent) the water that enters it. The salt marsh has two dominant plants that grow successfully in it: salt marsh cord grass (also called spartina), and black needle rush. A freshwater marsh is not tidal and is created by rivers, lakes, ponds and streams. The plants in a freshwater marsh are herbaceous (soft stemmed) and include grasses, sedges and cattails. A swamp is a freshwater wetland with woody stemmed plants in it, such as shrubs and trees. Dune environments are created on beaches and barrier islands when sand builds up, and plants take root. Dunes grow as these plants collect wind blown sand. Usually the plants growing on dunes are grasses and shrubs, but sometimes trees grow there also. The forest is a habitat filled with trees and other kinds of plants, both woody and herbaceous. The seashore (or beach) is a another type of habitat. The animals that live in the surf zone (also called a swash zone) are very specialized to living under conditions that are at times dry (when exposed during low tide) and at times submerged (when the waves come back in at high tide). The gulf, sound and bay are other habitats where the residents are determined by the varying degrees of salinity. Grass beds are very fragile habitats that are found in bays and sounds. In them grass such as eel or shoal grows and supports myriad forms of sea life.

HABITAT CARDS

Suggested Procedure:

1. Prepare "Habitat Cards" by writing on index cards names of plants, animals, and parts of habitats listed on the habitat information page (immediately following). It would be advantageous to also draw a picture of the animal, etc. above the name. This will help students who are not familiar with a particular item and also give them clues to know how to portray their habitat card.

2. Ask the students what animals (including themselves) need in order to survive. The basic requirements of any animal are: food, water, shelter, and living space. Discuss these with the students, and ask them how their needs for survival are met. Define what a habitat is: the place where a particular plant or animal finds its basic survival requirements.

3. Define the different types of habitats that occur along the Gulf coast: forest, dune, marsh (freshwater and saltwater), pond, gulf, surf, and grass bed.

4. Hand out one habitat card to each student, and have them keep their cards secret from everyone else. Students, one at a time, will act out their card (sound effects are encouraged). The class will try to guess what they are, and the student can eventually divulge the answer if no one guessed correctly. Once the entire class has acted out their cards, choose a habitat, but don't let the class know what it is. Call each student (by their inhabitant name) up front who belongs in that habitat. Ask them to act out their cards at the same time, which will essentially act out the habitat. Have the rest of the class try to guess the habitat. If the habitat has not been identified, begin by having each individual identified. Then if the habitat still isn't guessed, tell the class. Have each member of the habitat tell the class how they contribute to the habitat (for example: what do they eat, who eats them, what use they serve to other inhabitants). Go through each habitat until they all have been acted out.

   Note: When selecting the cards to use, don't try to use every habitat for a small class. Adjust the number of habitats used by the number of students in the class (for example, for a class of twenty-five, three or four habitats would be good). The next time the game is played, other habitats can be used, or different creatures within the same habitats.

5. Discussion can continue about plants and animals that are dependent on a particular habitat to live. For example: clapper rails and salt marshes; beach mice and dunes; pitcher plants and wetlands (an area that drys out sometimes and is wet other times); cattails and fresh water marshes. In order to protect certain species of plants and animals their habitats must also be protected. This is one of the purposes of Gulf Islands National Seashore -- protection of habitats.

HABITAT CARDS

Habitats and Inhabitants

Fresh Water Pond	Forest	Dune	Bay/Sound
cattails	magnolia tree	beach grass	eel grass
pond lily	slash pine	sea oats	oysters
gar (fish)	live-oak	beach flea	shrimp
dragonfly	tree frog	mosquito	comb jelly
bullfrog	box turtle	coachwhip snake	pipefish
snapping turtle	king snake	glass lizard	menhaden
alligator	cardinal	racerunner	pinfish
water snake	woodpecker	snowy plover	flounder
heron	rabbit	laughing gull	dolphin
fox	squirrel	beach mouse	least tern
mud	dead leaves	sand	calm water

Salt Marsh	Surf Zone	Gulf
spartina grass	seaweed	plankton
needle rush	coquina clam	sargassum weed
mullet (fish)	polychaete worm	moon jellyfish
grass shrimp	horseshoe crab	sargassum fish
fiddler crab	sand dollar	cobia (fish)
periwinkle (snail)	moon snail	redfish
clapper rail (bird)	ghost crab	sea turtle
red-winged blackbird	mole crab	dolphin
raccoon	willet (bird)	shark
slow moving water	black skimmer	pelican
detritus	waves	rough water

* People can also occur in each of these habitats, so they can be included if desired. These are some examples of habitats and inhabitants, there are many more that can be used.

PARK VOCABULARY

Subject: Vocabulary, Science
Duration: 1 hour
Location: Classroom
Related Activities: All Activities

Objectives:

To expand or strengthen the students' vocabulary by learning words related to the natural environment.

Materials:

* Copies of the enclosed worksheet
* Pencils

Method:

Many of the words in this lesson will be used throughout the book. The words can be discussed ahead of time if they are new to the students. Then the students will fill in the "Worldly Words" worksheets.

Background:

All words used in this lesson are defined in the glossary.

Suggested Procedure:

1. The following words will be used in the "Worldly Words" worksheet. Discuss any new words with the class ahead of time. Write the new word on the blackboard, and ask the students if anyone knows what it means. Write the definition of the word on the blackboard. Continue this method for each new word.

2. Leave any newly defined words up on the blackboard, and have the students fill out the "Worldly Words" worksheet Part 1 and/or Part 2 using the vocabulary list(s). If the students are advanced, do not hand out the list(s) of vocabulary words.

3. When the worksheets are completed ask each student to pick out a favorite word from the lesson. Have each student tell the class about the word they picked, what it means, and why they chose it.

Suggested Procedure (Con't):

4. An additional activity that can be played after words have been introduced is "hangman." To play, choose a secret word that the class will try to guess. Then draw short lines on the blackboard, one for each letter of the secret word. Next to the lines, draw an upside down "L" which will serve as the gallows. Have the students (one at a time) guess a letter that they think might be in the secret word. If they are correct, the letter goes above the proper line(s). If not, then the letter is written below the lines, and one body part of a person is put on the gallows. The basic body parts for the game are head, neck, body, arms, legs, hands, feet. To extend the length of play, the following parts can be added: hair, fingers, toes. In order to win, the word must be guessed before the person is completed on the gallows.

PARK VOCABULARY

Words for Worldly Words Worksheets:

PART 1 WORDS	PART 2 WORDS
amphibians	adaptation
barrier	camouflage
carnivores	chlorophyll
consumers	cold
endangered	crepuscular
environment	diversity
extinct	evaporates
herbivores	exoskeleton
insectivores	invertebrates
mammals	life cycle
omnivore	metamorphosis
producer	photosynthesis
scavengers	skeleton
species	vertebrates
warm	water cycle

PARK VOCABULARY

Answers for Worldly Words Worksheets:

PART 1 ANSWERS

1. barrier
2. amphibians
3. species
4. mammals
   warm
5. carnivores
6. scavengers
7. herbivores
   insectivores
   omnivore
   consumers
8. producer
9. extinct
10. endangered
11. environment

PART 2 ANSWERS

12. chlorophyll
13. photosynthesis
14. diversity
15. vertebrates
    invertebrates
    vertebrates
16. adaptation
17. camouflage
18. skeleton
    exoskeleton
19. metamorphosis
20. life cycle
21. evaporates
22. water cycle
23. crepuscular
24. cold

WORLDLY WORDS - PART 1

NAME: _____ **DATE:** _____

1. Along the Gulf Coast there are many islands. These islands are very important because they protect the mainland from big waves. They are called _____ islands.

2. Frogs, salamanders, and newts are _____ because they are born in water, but as adults they can live on land.

3. A _____ is a particular type of plant or animal that is different from another plant or animal in some way.

4. Human beings are _____. So are whales and mice and monkeys. All of these animals are _____ blooded.

5. _____ are animals (or sometimes even plants) that eat other animals. These plants and animals are also called predators.

6. _____ are animals that keep the world clean because they eat dead plants and animals. Plants that do this are called decomposers.

WORLDLY WORDS - PART 1

NAME: _____ **PAGE 2**

7. Plant eating animals are called _____ and insect eating animals are called _____.

   An animal that eats both plants and other animals is called an _____.

   All of these animals are _____ because they eat other plants and animals for food.

8. A plant is considered a _____ because it absorbs energy from the sun, and provides food for other creatures.

9. _____ means gone forever.

10. An _____ species is a plant or animal that is in danger of becoming extinct.

11. The _____ is the place where all the plants and animals on the earth live.

WORLDLY WORDS - PART 2

NAME: _____ **DATE:** _____

12. _____ is what makes plants green and also what the plants use to help harvest energy from the sun.

13. _____ is the process in which plants produce their own food, in the form of sugars, by using energy from the sun.

14. _____ means variety, and bio-_____ (use the same word) means a variety of living things.

15. _____ have backbones and _____ not. Human beings are _____ (one of the previous words).

16. An _____ is a feature or behavior that helps a plant or animal to survive.

17. _____ is a coloration or behavior that a plant or animal uses to blend into its surroundings.

WORLDLY WORDS - PART 2

NAME: _____ **PAGE 2**

18. This word means that an animal has its _____ on the outside of its body: _____.

19. A _____ takes place when a caterpillar becomes a butterfly.

20. The _____ _____ is the continuing development of an organism from birth, to adulthood, to raising of young, to death.

21. Moist air is formed when water _____.

22. The _____ _____ is the on going process by which rain comes down from the clouds, falls on lands and oceans, and evaporates back up into the clouds.

23. _____ refers to an animal that comes out in partial darkness, especially around dawn and dusk.

24. Reptiles are _____ blooded animals.

WHAT IF THERE WASN'T A NATIONAL SEASHORE?

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: Habitat Cards

Objectives:

To teach students about conservation. To explain why National Parks are created and the stewardship that is necessary to maintain them.

Materials:

* Paper
* Pencils (crayons)
* Index cards
* Magic markers

Note: index cards need to be prepared ahead of time.

Method:

The students will create two "islands," one that is a National Seashore, and one that is not. Then they will be able to design their own islands choosing whatever structures and natural resources they want. Discussion will follow about the different islands created.

Background:

Making a National Park is very complicated. People have very different ideas about what a park needs to provide its visitors. Some will want a total wilderness experience. Others will want the comforts of home, running water, electricity, restaurants, and even television. In order to please as many people as possible, compromises must be made. What do you or the students want in a National Park? Here is the chance to design one. What would be included? How would it be maintained?

Suggested Procedure:

1. Prepare index cards to be used for the "Make Your Own National Seashore" activity. Write on index cards the names of natural resources, structures, and recreation facilities that could occur on an island. You can be very specific, general, or a little of each. Pictures could also be added to enhance the concept. The following suggestions are guidelines:

<u>Natural Resources</u>
Flowers and Grasses
Trees and Shrubs
Birds - gulls, herons, osprey,
eagles, pelicans, shorebirds

Suggested Procedure (Con't):

Natural Resources (Con't)
Fish and Crustaceans
Insects - butterflies, mosquitos, deer flies, gnats, bees, beetles
Mammals - deer, foxes, raccoons, mice, dolphins, people, cats, dogs
Reptiles - snakes, lizards, sea turtles, alligators
Sand - beaches, dunes
Water

Structures
Shopping Mall
Office Building
Houses or Condos
Factory
Grocery Store
Movie Theatre
Video Store
Bathrooms
Forts
Boardwalks

Recreational Facilities
Restaurant
Tennis Court
Go-Kart Track
Picnic Tables
Golf Course
Amusement Park
Swimming Pool
Waterslide
Snack Bar
Jet Ski Rentals

2. Explain to the students that they are going to build two islands, one that is a National Seashore, and one that is not. Draw and label the two islands on the blackboard. Then, one at a time, hold up the index cards and ask the students which island would have each feature? It is possible that both islands could have the same feature. Draw pictures of the items on the appropriate island. When all the cards have been used, compare the islands. Ask the students which island they would want to visit. Explain that this is why there are National Seashores -- to protect our natural and historic resources.

3. As an additional activity, have each of the students make their own National Seashore. As you hold up the cards, have the students draw the items on their islands if they want them. When all the cards have been used, have the students name their islands. Discuss the different islands that were created. Why were certain items put on their islands and not others? What would happen if insects were left out? Or a predator? Would flowers grow without bees? What effect would cats and dogs have on their islands? Discuss stewardship, and ask the students if they would have any rules for their islands. How will they maintain their islands? Will they have friends out to their islands? What precautions would they need to take if they had visitors? Would they allow them to step on their flowers, or walk all over their dunes? This will help the students understand how many different opinions there are about the management of a National Park.

Suggested Procedure (Con't):

4. Define stewardship to the students, and explain that it means "taking care of and protecting." This is done in National Parks so that people can enjoy the parks, and also so that wildlife habitats are preserved for the plants and animals that live in them. There is a fine line to be made between what is best for wildlife and what is best for people. People want to see wildlife, so roads and other facilities are built, but areas also need to be kept wild in order for plants and animals to thrive. Wilderness areas are established for this purpose. These places are left in their natural state. People may visit wilderness areas, but no conveniences are placed there for visitors. This allows the plants and animals to remain relatively undisturbed. The best idea to keep in mind to help protect wilderness is that we all share this earth together. If we tread lightly, leaving only our footprints wherever we go, we will be contributing to the stewardship of our planet.

5. Discuss what conservation means. National Parks are created to protect and care for spectacular, ecologically diverse, and historically important areas. Explain that setting aside land is only the first step -- education, stewardship, and preservation of the land for future generations must follow.

MARINE DEBRIS

Subject: Science, Ecology
Duration: 1 hour
Location: Classroom
Related Activities: Let's Go Recycling

Objectives:

To teach students the importance of keeping our waters clean and free from debris. To learn about recycling and why it is so valuable.

Method:

Discuss marine debris with students and its effects on the environment. A recyclable lunch demonstration shows the students how they can participate in helping to reduce litter. A children's and teacher's pledge is enclosed to join the movement to keep the Gulf clean. Helping with a beach clean-up or starting a recycling program at school are additional ways to keep American green!

Materials:

* Six-pack ring
* Empty soda can
* Plastic bag
* Bottle
* Lunch box
* Plastic containers
* Thermos
* Lunch bag
* Plastic (or wax) wrap
* Juice box (or other disposable-type drink)
* Dessert in wrapper

Background:

Marine debris is a major issue with many environmentalists these days and with good cause. Marine debris is not only unsightly and unhealthy, it can be fatal to marine life. Many whales, turtles, dolphins, fish, and seabirds become entangled in floating trash, or sometimes mistake it for food and end up dying from blocked intestines. Why does this happen? When balloons and plastic bags end up in the water, they soon loose color and become transparent. At this stage, they look a lot like jellyfish, a common food item to many marine creatures. They attempt to eat the "jellyfish" by taking bites out of it or sometimes swallowing it completely. As a result, this plastic may clog their intestines either partially or completely, resulting in death. Six-pack rings and fishing lines are other deadly items in the seas. They get caught around necks of birds, gills of fish, and fins of marine mammals. All types of marine debris are collected and surveyed during coastal beach clean-ups: cans, bottles, plastic bags, six-pack rings, rope, fishing line, crates, oil cans, lightbulbs, styrofoam and many, many other items. The trash is counted and catalogued. From these surveys it has been determined that the trash is coming from recreational boats, commercial fishing boats, cruise ships, merchant ships, military vessels, oil rigs, and beachgoers. The garbage that ends up in the oceans takes many years to disintegrate. Rope takes about 1 year, a tin can about 100 years, an aluminum can between 200 and 500 years, plastic about 450 years, and glass is unknown.

Background (Con't):

Another major problem in our oceans are oil spills. These have more immediate results. If we all do our part to conserve energy, recycle, and keep our coasts clean, we will help our environment be healthy and beautiful.

Suggested Procedure:

1. Discuss with the students what marine debris is and how it gets into the water. Show them empty soda cans, bottles, six-pack rings, candy wrappers, plastic bags, fishing line, etc. Ask the students who they think is putting garbage such as this into the water? What to they think can be done about it?

2. Have the students (and teacher) fill out the enclosed Concerned Citizen's Pledge for keeping garbage out of the water, and cleaning up other trash when possible. Explain to students about releasing balloons, and how they can travel many miles out to sea, even if released from interior states. This creates problems when marine animals try to eat these "jellyfish." It's okay to have balloons, just try not to let them go. If the students are interested, they can bring home copies of the Concerned Citizen's Pledge and have their parents and siblings sign them.

3. Six-pack rings, plastic bags, and fishing lines are deadly to many sea creatures. Have each student find a six-pack ring and some other type of garbage that has been discarded carelessly by someone. Have them bring this garbage into the classroom. Discuss with the students that every six-pack ring, or other piece of dangerous garbage that they pick up is one less that could end up harming a bird, turtle, dolphin, or other marine animal. Have the students cut the loops off the six pack rings and throw them into the garbage along with the other trash they have collected. Suggest that they cut up all six-pack rings at home before throwing them away, because sometimes animals get into the landfills where the garbage is dumped, and this would prevent an animal from getting caught in it!

4. Have a recyclable lunch demonstration. Bring in two lunches to show the class. Make one totally recyclable using plastic containers, a reusable lunch box, and a reusable drinking container. Make the other totally disposable, with excess packaging, in a brown bag. Tell the class this experiment will take two days. The first day, eat the brown bag lunch, and put all of the garbage in a pile. The second day eat the lunch in the containers, and put any garbage left from it in another pile (perhaps just a paper napkin). Discuss with the class how reducing the amount of waste is the first step to solving the garbage crisis. If every student reduced the amount of garbage generated by their lunches, how much less garbage would there be?

Suggested Procedure (Con't):

5. Other activities that feel good to do and are good for the environment are to get involved in a beach clean-up and to recycle in school. Beach clean-ups are fun, and almost every coastal community has one. The "Take Pride in the Gulf" clean-up is always scheduled on the next to the last Saturday in September. This could be a possible field trip or exercise for extra credit. The materials found could be surveyed by the class, and the results charted on a graph. Recycling can help reduce the amount of litter around our coasts, and it saves energy and natural resources too. If the school currently has a recycling program, set aside a place to store recyclables (labeled cardboard boxes work great), and then once a week, have the class take their items to the place where the recycled materials are gathered in the school. Tell them that the bigger the piles are in the boxes, the cleaner they are making their environment. The students can also collect items that were littered by other people and recycle them too. Encourage students to recycle at home and to ask their parents to buy recycled products or products with less packaging. If your school does not currently have a recycling program, see Appendix A for information on how to start one. Happy recycling!

CONCERNED CITIZEN'S PLEDGE

I AM A CONCERNED CITIZEN, AND I FEEL THAT THE WATERS OF THE GULF OF MEXICO, AND ALL ASSOCIATED WATERS AND COASTLINES, ARE IMPORTANT PUBLIC AND ENVIRONMENTAL RESOURCES.

I WANT TO HELP TO PROTECT OUR COAST AND BE AN "ENVIRONMENTAL RANGER."

AS AN ENVIRONMENTAL RANGER,

I WILL NOT THROW TRASH ANYWHERE EXCEPT IN A GARBAGE CAN	I WILL RECYCLE WHENEVER POSSIBLE
I WILL HELP PICK UP OTHER PEOPLES' GARBAGE WHENEVER POSSIBLE	I WILL TRY TO PREVENT ACCIDENTAL LOSS OF GARBAGE, FISHING SUPPLIES, OR BALLOONS

I WILL HELP MY COAST TO STAY CLEAN AND HEALTHY

NAME _____ **DATE** _____

***** CONGRATULATIONS, YOU ARE NOW AN ENVIRONMENTAL RANGER *****

WHAT IS AN ISLAND?

Subject: Science, Geography
Duration: 1 hour
Location: Classroom
Related Activities: How is an Island Formed?

Objectives:

To teach students what an island is and what would be needed for survival on an island.

Materials:

* Map of the U.S.
* Pencils
* Paper

Method:

Discuss with students the definition of an island. The class can share experiences regarding islands they have visited. Then each student will be asked to put together a list of necessities if they were going to live on an island. Discussion can follow.

Background:

The formal definition of an island, according to Webster, is "a tract of land surrounded by water and smaller than a continent." When first thinking about this definition, it seems very general. But considering how many different types, shapes and sizes of islands it becomes clear that only a general statement can apply to all islands. Islands may be made of sand, shell, volcanic ash, rock, dirt and many other natural substances. Some will have trees, some will not. Some won't have any vegetation at all. Some will be inhabited, some deserted. Some may have mammals, some may have reptiles, and some will have none. Whatever resources the island does not have, the one feature it will have is water. Islands may be found in fresh water, salt water, or brackish water. Some will be extremely small, and some will be vast. Whatever the features of an island are, it will most definitely be interesting.

Suggested Procedure:

1. Discuss with the students what makes an island an island. What conditions need to exist? What is the location of an island? What are the possible sizes of an island? What is a barrier island?

2. Show the students the location of the Gulf islands on a map. Gulf Islands National Seashore contains all or part of six of these islands -- West Ship Island, East Ship Island, Horn Island,

Suggested Procedure (Con't):

Petit Bois Island, Perdido Key and Santa Rosa Island. Have any of the students (or teacher) been to these islands? What were they like? Discuss how barrier islands protect the mainland and the fragile marsh system along the coast -- they act as buffers for the waves that come in from the Gulf of Mexico, and they are crucial during storms to lessen the waves' severity.

3. Discuss other well known islands such as Hawaii, Puerto Rico, Virgin Islands, Manhattan, etc. Have any students been to these or other islands? What were they like? Were the islands in a natural state or developed? What is the difference between these islands and the more fragile barrier islands?

4. This is everyone's chance to live on a deserted island. As an activity, have the students make a list of what they would need to survive on a deserted island for a month. Have them think about what their island would be like. Give them about fifteen minutes to write down the items. Have them make their lists as complete as possible. Discuss the different lists with the class. Did everyone bring food, a cooking stove, fuel, matches, water (lots of drinking water would be needed), safety equipment -- flashlight, first aid kit, bug spray, sun screen, protective clothing, hat, sleeping bag, tent (or something for protection from the elements and the bugs), medicines? How would food be prepared? Was anyone going to catch their own food -- did they bring along backup food just in case? Did they plan a balanced diet, or were certain food groups eliminated? Did anyone bring equipment that needed electricity? How would it run? If batteries were needed, were extras brought along? Did anyone bring a camera or a journal to record island experiences? In the case of an emergency, how could communication be established with the mainland? What were the student's islands like -- did they have trees, flowers, sand, shelter, fresh water, animals? What was the temperature on their island, and how was the weather? What did they do on their islands for a month? Did they enjoy themselves?

HOW IS AN ISLAND FORMED?

Subject: Science
Duration: 1 hour and a few minutes daily
Location: Classroom
Related Activities: Where Did the Sand Come From?

Objectives:

To teach students the different ways in which islands are formed and how life develops on them.

Materials:

* Plastic washbasin
* Water
* Sand
* Bean seeds
* Spray bottle (optional)

Method:

Discuss with the students the current theories on the formation of islands. Explain the growth processes that take place on an island after formation. A model of a small island will be built as a class project.

Background:

Islands are formed by a variety of natural forces. Volcanic action is one of the most dramatic ways in which an island can be formed. Hawaii and the Galapagos are very well known chains of islands that were created in this way. The islands along the Gulf of Mexico coastline are barrier islands. These long and thin isles of sand are invaluable to the protection of the Gulf's mainland areas. Barrier islands act as buffers that reduce the force of the waves from the Gulf. During a storm they play a very crucial role. The formation of these barrier islands began with end of the last ice age over 10,000 years ago. Since then, the sea level has been rising all over the world. In some areas along the Gulf Coast, the shoreline has moved up to eighty miles inland because of higher water. The following theories are used today to explain how barrier islands form. Some barrier islands may have been created as the sea level rose and the water covered parts of the mainland. In the flooded areas, high places that remained above sea level became islands. Another theory explains that the mainland areas that were flooded by rising seas also left shoals, or shallow areas, in the Gulf. Over time, these shoals built up into sand bars, and eventually they became islands by the movement of sand from the continental shelf. A third theory proposes that some islands are formed as spits (elongated deposits of sand created due to erosion of the mainland area) which separate from the mainland after flooding covers the area where the spit attached to the mainland. Geologists cannot say for sure how a particular island was formed unless they were able to witness its creation.

Once an island is formed, many natural processes take place. A barrier island is constantly changing in size and shape. Sand moves from one end of the island to the other by waves and currents. The prevailing littoral current in the Gulf of Mexico is from east to west, which accounts for the pattern

Background (Con't):

of change in the Gulf Islands. These islands are growing on the western tips and shrinking on the eastern tips. Barrier islands can move many miles from where they began. Vegetation begins to grow on an island when seeds arrive. Seeds may be dropped by blowing winds, or from visiting birds, or carried by water from the mainland. Birds bring seeds attached to their feet and feathers, and others are transported in their digestive systems. Bird droppings (guano) are full of nutrients and make a rich fertilizer. Rainfall helps seeds germinate. Eventually animals will move onto the island. Some will fly there, some will swim, some will be carried to the island by floating debris or by people in boats. The island will grow and continue to evolve throughout its "lifetime."

Suggested Procedure:

1. Discuss with the students the ways in which islands are formed. Explain that the islands along the Gulf coast are called barrier islands. This is because these islands protect the mainland from the full force of the waves in the Gulf. During storms this is very important. Tell the students what occurs after the island is formed. Explain how the island develops and the many changes that take place.

2. Create an island as a class project. Fill a plastic washbasin with about three inches of water. Put a layer of sand evenly across the bottom to simulate the ocean floor. Every day, in the same spot, pour in a scoopful of sand. Continue filling the basin with sand until the island shows above the surface of the water. This may take many days -- after all, an island grows slowly. When there is sufficient space for plants to grow, gently place a mixture of seeds on the island (alfalfa, kidney bean, pinto bean, whole pea, etc. could be used). The seeds can be pushed softly into the sand, and a small amount of sand can be poured over them. To simulate rainfall, if desired, use a misting bottle on fine spray. (This is not necessary for growth, but it is something to do while the students are waiting). If shifting occurs, small amounts of sand can be added occasionally. Once the plants have grown, discuss the outcome with the students. What does the island look like now? Could anything live on this island? Have any insects moved in? How would winds and waves affect the island? Would the roots of the plants help to hold the island together?

3. Have the students write a story about their island.

WHERE DID THE SAND COME FROM?

Subject: Science, Geography
Duration: 1 hour
Location: Classroom
Related Activities: Who Lives in the Sand?

Objectives:

To observe and learn about the different components that make up the sand on the Gulf Islands and how they got there.

Method:

By studying the granules of sand up close, their contents can be examined. Discussion of erosion and particle movement by rivers and littoral currents. An activity of making a stream table will show how sand is carried downstream to the Gulf.

Materials:

* Sand
* Washbasin
* Water
* Cup
* Hand lenses
* Sieve
* Magnets
* Small piece of cloth
* Map of the U.S.

Background:

The technical definition of sand is that it is made up of particles ranging in size from .05 millimeters to 2 millimeters. Particles larger than 2 mm are considered gravel; those smaller than .05 mm are considered silt; and those less than .004 mm are considered clay. Sand is made up of many different components. Most of the sand along the Gulf Coast originally came from the southern Appalachian mountains. The sand was created when metamorphic rocks were eroded. Some of the major causes of erosion are: chemical reactions (which can be caused by living organisms); abrasion of rocks which have been uplifted; and the actions of weather, gravity, and vegetation. It was previously thought that sand was created by rocks being rolled downstream by rivers, constantly getting smaller and smaller. Now this is only considered a very small contribution to the vast amount of sand on the earth. How much sand is there on earth? A low estimate is 10 million cubic miles -- enough to wrap around the earth once, at a thickness of three miles! Most of the sand that makes up the Gulf Coast barrier islands comes from the continental shelf. It was deposited there thousands of years ago, and constant movement by currents brings it ashore. Sand also comes from rivers and the erosion of the mainland. Some islands are more dependent upon sand from rivers than others. Some islands actually get sand from other islands. Every island is an individual, with different requirements for creation and growth from one to the next.

WHERE DID THE SAND COME FROM?

Suggested Procedure:

1. Discuss with students what sand is and how it is formed. Explain the process by which rivers carry eroded rock downstream. Tell the students about the history of sand being deposited onto the continental shelf. Sand still continues to be washed downstream into the Gulf by the many rivers that flow into it. Point out on a map of the United States the location of the Appalachian Mountains, and the rivers which carry the sand southward.

2. Have the students look at grains of sand through hand lenses. What do they see? Have the students try to find as many different grains as possible. Are some grains smooth and others rough? The smooth grains are formed by being blown around by the wind. Impact with other grains causes the jagged edges to be worn off. The light (and larger) crystals are mainly quartz. If sand grains are not too fine, sifting the sand through a sieve will keep the larger particles such as quartz while filtering out the other minerals. Shells that have been broken down also make up a small part of the sand you are looking at. They are not clear or transparent like the quartz. The darker crystals in the sand are minerals, including: Ilmenite, Hematite, Tourmaline, Magnetite, and Garnet. If minerals that contain a significant amount of iron (Magnetite primarily, and Ilmenite) are present, they will be attracted to a magnet. In order for the students to observe the grains once they are picked up by a magnet, first cover the magnet with a thin piece of light-colored cloth.

3. To demonstrate how a river carries grains of sand downstream, set up a small stream table. Using a washbasin (anything longer would be ideal), fill one end with sand and a few rocks. Tilt the washbasin so it is on a slight incline. Slowly pour water over the sand and watch the grains move along with the flow of the water. Did any of the rocks move? If the water was running faster would it have a different effect? Moving water will be able to carry lighter particles further than heavier ones. If the water moves faster, it will have more power, and could move objects it was not able to move before. If possible, take the students outside to observe a stream in action. Have them study the stream and write down their observations. They could also study the movement of the water by putting a piece of lightweight plastic (or some other object that would float) into the stream. Have someone retrieve it at the other end. How did the object move? Which areas of the stream are the deepest, and which have the most sand, mud, or clay deposits? Water will be the deepest around the outside of a turn, and the inside will contain more sediment.

WHO LIVES IN THE SAND?

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: Habitat Cards

Objectives:

To teach students about life at the seashore -- what the creatures are like and why.

Materials:

* Copies of the enclosed worksheet
* Pencils

Method:

Discussion about the animals that live in the sandy beach and intertidal zone. An activity, "Seashore Stars," will follow. Students can also make plaster cast of animals tracks if a trip to a seashore is taken.

Background:

The seashore is divided into two main types of habitats: the dry sandy part of the beach above the high tide line, and the intertidal zone, also known as the surf or swash zone. The upper beach is almost always dry (except after precipitation), and the animals who live in it have adapted to surviving in a hot, dry environment. The swash zone is always in a state of flux. It is either on the way to being at high tide or heading toward low tide. The animals that have made this area their home are able to deal with being flooded out at times, and being exposed to dry and hot conditions at other times. Many different animals visit both of these habitats to feed on the creatures that live in them.

Some of the inhabitants of the Gulf Coast swash zone are: common mole crabs, square-backed mole crabs, coquina clams, polychaete worms, and small, insect-like creatures called amphipods. All of these animals burrow in the wet sand. The mole crabs, clams, and worms have appendages that remain above the sand and filter out food from the constantly moving surf. The coquina clams migrate up and down the shore between low and high tides. They do this by following the vibration of the waves. Amphipods feed on detritus and also burrow themselves in place when the powerful surf rushes by. Some animals that visit the intertidal zone are: sand dollars, horseshoe crabs, hermit crabs, lettered olives (a type of snail), moon snails, comb jellies, moon jellies, nudibranchs (also called sea slugs), sandpipers, herons, egrets, and people. Some come for food, some to breed, and some to play in the surf. Above the high tide line, another community is busily at work. Ghost crabs, who have burrows in the sand to escape the heat of the day, hunt the tide line by night for food. They are mostly predatory, but will also consume remains of dead animals found on the beach.

Background (Con't):

Ghost crabs also need to return to the water to refresh the salt water stored in their gills and they can often be seen doing this during the day. Snakes, beach mice, raccoons, skunks, tiger beetles, and people also visit the upper beach. Some come for food, and some come for fun. Between the two communities, there is always a lot of action at the beach!

Suggested Procedure:

1. Discuss with the students the various inhabitants of the seashore. Have they ever encountered any of these creatures? What are some of the special adaptations these animals have developed for survival in their habitat? What do some of these creatures eat? Some are filter feeders, such as the mole crabs, coquina clams, polychaete worms; some are predatory, such as moon snails, lettered olives, and ghost crabs; and some are opportunists, such as raccoons, and skunks.

2. Have the students fill in the "Seashore Stars" worksheet. Discuss the answers with the class. Have the students each pick a seashore creature that they think is interesting, and have them discover one interesting fact about it.

3. Seashore creatures all leave some sort of track or trail when they move about. If a trip to a seashore is taken, a great activity for the students is to find an animal's track and make a plaster cast of it. Appendix A has complete directions.

SEASHORE STARS

Name: _____ **Date:** _____

1. Mole crabs roll up the beach with the waves and then _____ into the sand to stay in one place.

   a. swim
   b. burrow
   c. fly

2. Sandpipers are small birds that run up and down the shoreline looking for _____.

   a. food
   b. a drink
   c. a good place to catch some rays

3. Sea turtles come ashore during the night to _____.

   a. play flashlight tag
   b. lay eggs
   c. dry off

4. Horseshoe crabs are actually not _____ at all.

   a. poisonous
   b. crabs
   c. both a and b

5. Ghost crabs were probably named because they _____.

   a. scare people
   b. are white and come out at night
   c. howl

Name:_____ **Page 2**

6. Coquina clams actually _____ back and forth with the tide.

a. dance
b. jump
c. move

7. Hermit crabs have to get new shells periodically because they _____.

a. grow too big for their old homes
b. want a color change
c. are bored

8. Herons have big pointy bills to _____.

a. play piano
b. poke each other
c. catch fish

9. Beach mice need _____ to live in.

a. condos
b. sand dunes
c. restaurants

10. Without beach mice, the coachwhip snake might _____.

a. have a party
b. be lonely
c. go hungry

Name:_____

11. Polychaete worms have a funny name and they use feathery antennae to _____ particles to eat.

a. trap
b. tickle
c. scare

12. Moon snails and olive snails _____ little coquina clams.

a. are friends of
b. love to eat
c. help protect

13. Comb jellies are beautiful little creatures who _____ at night.

a. light up
b. sing opera
c. play flashlight tag

14. The place where the waves move back and forth on the shore is called the _____.

a. twilight zone
b. intertidal zone
c. back and forth zone

15. People can help protect the beaches by _____.

a. not walking on the dunes
b. keeping them clean
c. both a and b

SEASHORE STARS -- ANSWERS

1. **b - burrow.**

   Mole crabs burrow into wet sand, bottom first, and feed by filtering particles from the water.

2. **a - food.**

   Sandpipers eat marine worms and coquina clams buried in the wet sand along the tide line.

3. **b - lay eggs.**

   Female sea turtles (Green, Hawksbill, Kemp's Ridley, Leatherback, and Loggerhead) come ashore along the Gulf coast to lay eggs in a big pit they dig in the sand. She then leaves her eggs covered over with sand and returns to the sea. They will hatch in about 30 days (if they haven't been eaten by a predator) and they will have to make it to the water on their own. If they make it, they will live for many years in the floating sargassum weed where they will have food and protection.

4. **c - both a & b.**

   Horseshoe crabs do not sting, and are not poisonous, unlike the stingrays which they are so often compared to. They are not crabs, they are actually in a family all their own, called merostomata (see "Creature Features - Starring the Horseshoe Crab" for more information).

5. **b - are white and come out at night.**

   See background section for more information.

6. **c - move.**

   See background section for more information.

7. **a - grow too big for their old homes.**

   Hermit crabs, like all crabs, are constantly growing. As they grow, they must find new larger shells to move into. They usually use empty auger, lettered olive, moon snail and whelk shells.

8. **c - catch fish.**

   Herons can spear fish with their pointed bills or use them like tongs. They could also use the bill as a weapon if they were in danger. Herons hunt by wading in the water, standing still, and catching fish as they swim by.

9. **b - sand dunes.**

   Beach mice are very specialized creatures. They live in the sand dunes on beaches and feed on beach grass. They are very susceptible to eradication due to development of beaches.

10. c - go hungry.

Beach mice are a staple food in the diet of the coachwhip snake.

11. a - trap.

Polychaete worms are the most common marine worms in the oceans. Some are free swimming, and others are burrowing or sedentary. The sedentary polychaetes live in tubes and remain inside them for life. The burrowing polychaetes can move from place to place, and then burrow into the sand when desired. The sedentary and burrowing polychaetes feed using feathery tentacles that filter out particles from the water. The free swimming polychaetes are usually carnivorous.

12. b - love to eat.

Both moon snails and olive snails are predatory. They each dig tunnels in the sand to move through in search of prey. The olive snail has a very large foot which probably used to suffocate its prey. The moon snail grasps its prey with its large foot, and then uses a radula to drill a hole through the shell to the meat. Many shells along the beach carry the mark of the moon snail.

13. a - light up.

Comb jellies are not true jellyfish. Most of them cannot sting. They have eight sections with comb rows of hair-like cilia between each. They use these for swimming, moving mouth first through the water. Plankton is trapped on the tentacles of the comb jelly and then brought to the mouth to eat. Even though they can move about on their own, comb jellies are considered planktonic because they are moved to and fro by waves and currents. At night, comb jellies look like they've been lit up. Behind each comb row, a bioluminescent glow reflects colorfully.

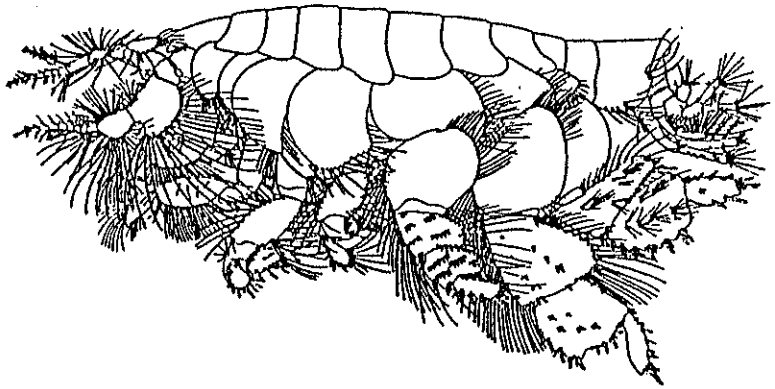
14. b - intertidal zone.

Also called the surf zone or the swash zone. It is the part of the seashore that is submerged during high tide and exposed during low tide.

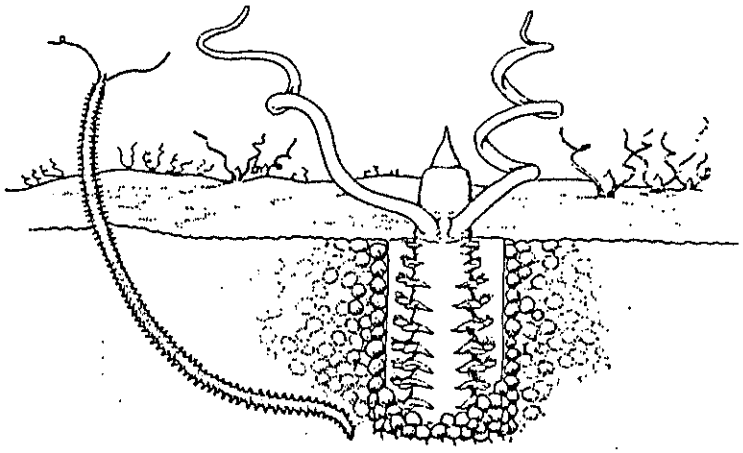
15. c - both a and b.

Dunes are very important to the seashore inhabitants. They are also very fragile. If they are walked across, the sand will be redistributed, and soon there will be no dune left. The vegetation on the dunes is also very critical, and it is important not to pick it. Garbage and marine debris that washes ashore is unsightly and unhealthy. If people remove their garbage, and help to clean up other people's garbage, the seashore will remain a beautiful place to visit.

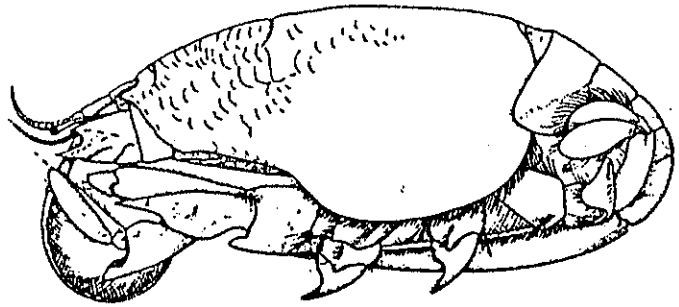
COMMON SWASH ZONE ANIMALS



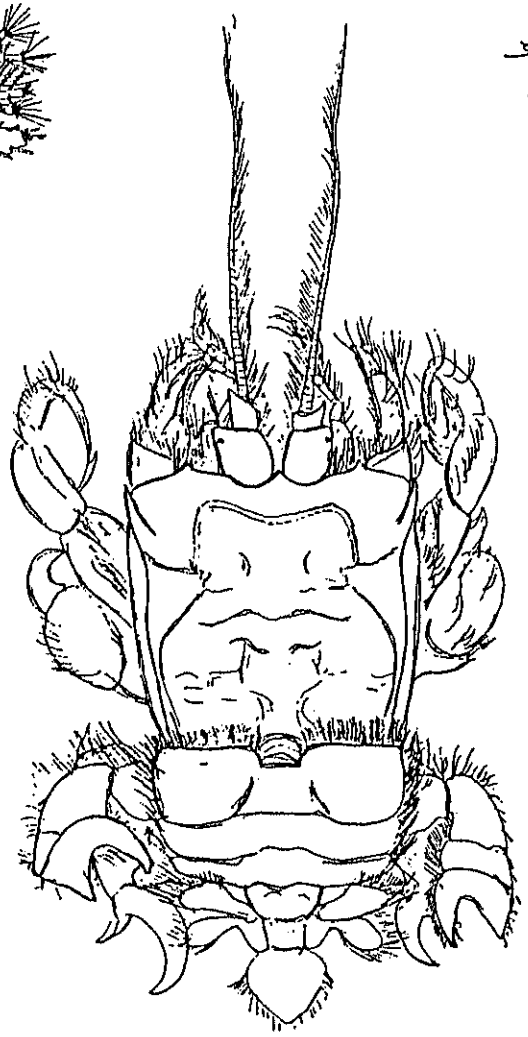
Burrowing Amphipod; Beach Digger
(*Haustorius jayneae*)



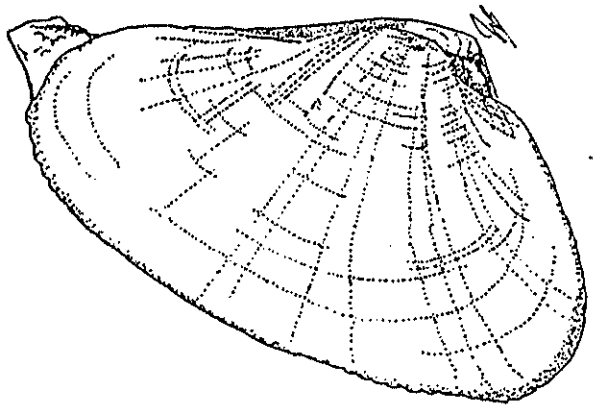
Polychaete Worm; Palp Worm
(*Scolelepis squamata*)



Common Mole Crab
(*Emerita talpoida*)



Square-backed Mole Crab
(*Lepidopa benedicti*)



Coquina Clam
(*Donax variabilis*)

PLANTS THAT HOLD ISLANDS TOGETHER

Subject: Science
Duration: 1 hour
Location: Classroom and Outdoors
Related Activities: The Island That Disappeared

Objectives:

To teach students about the root systems of plants and their relationship to soil erosion.

Materials:

* Water container
* Water

Method:

Explain the function of a plant's roots as they relate to the plant and to its environment. Discuss with the students the various plants that "hold together" barrier islands. Study the root systems of plants by observing them in and around the school yard. Perform an erosion test to determine the affects that plants' roots have in keeping soil from washing away.

Background:

The roots of a plant are very important to the plant, and to the environment the plant lives in. Whether they grow in a forest, or in a marsh, or on an island sand dune, plants help to hold the ground in place. They do this with their complex root systems, spreading in different directions in search of moisture, food, and nutrients. Roots also help to support the plant and keep it upright as it reaches for sunlight. Roots are the life support system of a plant. They are critical for supplying the plant with elements it needs for survival. As an extra benefit, these root systems which twist and wind around in the ground keep the soil firm and intact. Barrier islands are very dependent upon plants and their root systems to keep the sand from blowing away. The island sands are blown by winds and brushed by waves (sometimes pounded in heavy storms) everyday. If the plants were not there to absorb the shock of these powerful forces, the sand would be constantly rearranged and the dunes would disappear. Some of the plants that grow on the Gulf Islands are sea oats, beach grass, seashore elder, beach rosemary, wax myrtle, seaside evening primrose, beach morning-glory, woody goldenrod, sea rocket, sand live-oak, magnolia, slash pine, and loblolly pine.

Suggested Procedure:

1. Discuss plants' root systems with the students -- their primary function for the plants and their secondary function for the prevention of soil erosion. Ask the students to imagine what the world would be like without roots. Have them share their ideas with the class.

2. Take students outside in the school yard and ask them to observe the plants. Look for different types of plants such as grasses, flowers, shrubs, and trees. Can any of their roots be seen? What are they like? Try to find a location that shows roots imbedded in soil (an uplifted tree, an eroded bank). Does the root system appear to be holding on to the soil? What would happen to the soil if all the plants were removed from a particular area? Take the students to a baseball diamond (or any bare dirt patch) and explain how erosion is slowly taking place due to the lack of plants and the effects of wind and rain. If this area were on an incline, what effect would that have on erosion?

3. Perform an erosion test. A bare patch of ground on a substantial incline will be used, as well as a grassy sloped area. Using two buckets of water, slowly pour one bucket of water down the grassy slope -- what happens? How does the water flow down hill? At what rate of speed -- is it moving at the same rate that it was poured? Now pour water down the bare slope at the same rate. What happens as the water runs down the slope? Does it take anything with it? What speed is it traveling down the hill? Has the water altered the slope in any way? Follow up with a discussion on the observed relationship between plants and erosion. Ask the students why they think it is important to prevent erosion. Explain that this is one of the reasons why removing plants from islands, or clear cutting forests, is detrimental to the environment.

THE ISLAND THAT DISAPPEARED

Subject: Science, Geology
Duration: 1/2 hour
Location: Classroom
Related Activities: Plants That Hold Islands Together

Objectives:

To tell the students about the Isle of Caprice that once existed in the Mississippi Sound.

Materials:

* Isle of Caprice story sheet (enclosed)

Method:

Many stories have been generated by the disappearance of the Isle of Caprice. After reading a story containing the events that led up to the demise of the island, students will attempt to determine what caused it to vanish.

Background:

Between the Gulf of Mexico and the Mississippi Sound lies a chain of barrier islands. From east to west they are: Petit Bois, Horn, East Ship, and West Ship Islands. In between Horn Island and East Ship Island, there is a very important channel named Dog Keys Pass. In the middle of this channel, small islands have come and gone throughout recorded history. The most famous island that temporarily sat in the middle of Dog Keys Pass was called Dog Island. It was later renamed Isle of Caprice when it was purchased and developed for a pleasure resort. As far as scientists can tell, the Isle of Caprice emerged from a combination of a few small sand keys called the Dog Keys. The Dog Keys were first charted in 1854 and confirmed in a survey taken in 1917. Sometime thereafter, the Isle of Caprice was formed. It was very small, only about 2 1/3 miles long by 1/3 of a mile wide. In 1925 it was purchased by Walter "Skeet" Hunt. He, along with two other partners, began the work which converted the small sand key into a vacationer's paradise. There was a great recreation hall built on the island that contained a lavish restaurant, a ballroom where bands played and couples danced, and a casino. The entrepreneurs also built cabanas, a long pier to greet boats, a boardwalk, dressing rooms, a power plant for electricity, and an artesian well for fresh water. Swimming marathons, boat regattas, bathing beauty contests, fishing, dancing, sun bathing, swimming, and socializing were some of the popular activities on the island. Sea turtles' eggs were dug up and used for baking. Sea oats were cut by tourists and sold in stores on the mainland. In 1926 a hurricane passed over the Isle of Caprice, and even though it did no significant damage, it did erode part of the eastern tip of the island, and some buildings had to be relocated. As the years passed, the sea oats disappeared, and the island seemed to be getting smaller and smaller. In fact, it was getting smaller, and by 1931 it was a duneless sandbar. Later that year, fire destroyed the buildings on the island.

Background (Con't):

1932, it was under approximately four feet of water. All that remained of the tiny island was the water pipe from the artesian well, still spouting fresh water. Scientists have stated that the disappearance of the Isle of Caprice had less to do with the picking of the sea oats and the hurricane, and more to do with the pattern of shifting that normally occurs on sand keys. The supply of sand that the Isle of Caprice had been receiving in order to grow was, at some point, cut off, and the island began to erode. The sea oats were not seen as a major factor because the roots of the sea oats were not pulled -- only the stalks were cut. The disappearance of the plants may, however, have made the dunes more vulnerable, and hastened the erosion that was already taking place. Basically, the Isle of Caprice disappeared from Dog Keys Pass the same way that it arrived: by shifting sands and wave action.

Suggested Procedure:

1. Read the enclosed story about the Isle of Caprice to the class. Ask the students what they think caused the island to disappear. Legend has it that the sea oats were the major factor, but according to scientists, the erosion occurred naturally. Tell the students that such a small island as Caprice is very unstable and has come and gone with the shifting sands and powerful waves. Barrier islands are very dynamic, constantly changing shape and size. Discuss that even though the cutting of the sea oats was not the cause of the island's demise, plants are very important to the dune habitat in which they live. Plants help hold sand dunes together under normal conditions, and they also provide food and shelter for island animals. Ask the students if they think the island will ever reappear. No one knows for sure, but it certainly is possible.

THE ISLE OF CAPRICE

by Debbie Kanze

Many years ago, long before any of us was born, there was a group of very small islands called the Dog Keys. They were located in the Mississippi Sound, between two big barrier islands, Horn and Ship. They were so small, they weren't really noticed by anyone. Then one day, the Dog Keys grew together, and formed a bigger island. It had great sand dunes and beautiful golden colored sea oats. Around the island swam many fish, sea turtles, and dolphins. The sea turtles would come up onto the sandy beaches to lay their eggs. In the waves along the shore, the dolphins would play and catch fish to eat. The island was a special place, and it was named Dog Island.

Even though Dog Island was a small island, it attracted attention. Eventually a man bought it. The new owner thought that everyone would love Dog Island as much as he did, so he began a plan to share it with others. He gave the island a fancy new name, "Isle of Caprice," and with the help of some friends, he put up buildings on the island. Some were for dancing and dining, some were for game playing, and some were for staying overnight. Lots of people came to the island on big ferry boats that had music and dancing on board. These people came for fun and sun and water and friends. There were swimming races and bathing beauty contests. Fishing was a big sport on the island. So were finding sea turtle nests, digging up the eggs, and using them for baking. People loved the high sand dunes that rose up over their heads, and the golden shimmering sea oats that grew on top. The sea oats were so pretty that people cut them down for souvenirs and decorations. This became increasingly popular, and eventually no sea oats were left.

One year, a hurricane swept over the island and cut off the eastern tip. This caused damage to some of the buildings, and they were relocated. Afterward, business went on as usual. Travelers came from near and far, boat after boat after boat. Everything seemed to be working just perfectly on the little Isle of Caprice. Sometimes even famous personalities came by to visit this wonderful place.

Every year, people came to the island to enjoy its relaxing atmosphere. All along, as they were playing on the sand and in the water, dancing and laughing and relaxing, something was happening that no one knew about. The island was slowly disappearing. The sand that had been moved by waves to make the island was no longer available. It was carried to other places by the waves and currents. What would keep the island alive? It was caught between two channels of water that swept by each side of the island with every tide. Little by little the area around the island was eroding, but no one noticed because this area was under water. One year, people observed that the island seemed to be shrinking, and in fact it was. The next year, it was gone, buried under four feet of water. The only thing that remained was a water pipe that stuck up above where the island had been. Many people still miss the little island, and hope that someday it may return.

ISLAND SLICERS -- HURRICANES

Subject: Science, Weather
Duration: 45 minutes
Location: Classroom
Related Activities: The Island That Disappeared

Objectives:

To teach students about hurricanes -- how they form and what to do when one comes to town.

Materials:

* Copies of worksheet
* Pencils

Method:

Discuss with the students the definition of a hurricane. Explain how hurricanes are formed, and how they move about. Discuss recent or famous hurricanes that have hit the Gulf Coast. A worksheet "Hurricanes Happen Hurriedly" will be filled out.

Background:

Hurricanes begin with the sun. The sun heats the waters of tropical oceans. The water temperature will eventually reach 82 degrees or more. Since this doesn't usually occur until August, most hurricanes don't form until then. They will continue to form through November. The warm water, heated by the sun, is constantly evaporating and mixing with the warm air above the sea. This moist heated air rises upward in columns and forms cumulus clouds, which causes a low pressure system to form along the surface of the water. At the top of the column, the hot air is condensed, and heavy rains begin to fall. The sea below swells and the waves are pushed up into ridges of water. Add to this strong winds, and the seeds of a hurricane are sown. Even when all the conditions are met, hurricanes develop only a small fraction of the time. Once they do form, they may lose their power and die out, never reaching land. Or they may grow. The winds may begin to circle causing a vortex around a central calm (the eye of the hurricane). The whirl can grow stronger and stronger, spinning in a counterclockwise direction. In the Southern Hemisphere, hurricanes swirl clockwise. The heated air from the sea rises and fuels the powerful storm. Once the winds increase to 75 mph, a hurricane is born. It is unknown why hurricanes form at some times and not others. Scientists still do not understand all of the elements that go into the creation of a tropical storm.

Suggested Procedure:

1. Discuss with students how hurricanes are created. Talk about recent hurricanes that have hit the Gulf Coast, and also the infamous ones like Camille. What happened during these hurricanes? Ask the students what they think it would be like on an island in a hurricane. The most tragic example is what occurred in Galveston on September 8, 1900. Hurricanes were just beginning to be watched at that time, but no warning system yet existed to tell people when to evacuate. The waters began rising at 5 a.m. that day, and people were told to go to high ground. Of course there were no automobiles to drive off the island, and walking off at this point wasn't possible either. By early afternoon, all bridges to the mainland were flooded and impassible. By early evening, the gusts of wind exceeded 120 mph and half of the city was flooded. Houses tumbled, trees crashed, and the hurricane took its toll. By morning, 6,000 people had died. Hurricane Camille was a scale number 5 (winds above 155 mph) tropical cyclone. This is the most powerful type of hurricane there is. The Galveston hurricane was not rated a 5. Many, many lives were saved during Camille because people were evacuated. Some of course, did not evacuate, and many did not survive. Ship Island was actually cut in two by Camille. There is now an East Ship Island and a West Ship Island separated by about a mile of water. Untold amounts of damage occurred to personal property and to the natural resources of the coast.

2. Discuss with the class what to do when a hurricane is approaching. Listen to the television or radio to keep up-to-date on the path of the hurricane. Be ready to evacuate if necessary (don't wait until the last minute to prepare). Do evacuate if suggested - it is only recommended to save lives. Even though a hurricane is exciting and amazing, don't avoid evacuation and try to watch the storm. Have the students discuss with their families setting up an evacuation plan. What is the best evacuation route to follow? Where will they stay, and what will they need to bring? This could be done as a homework assignment, and then the students could share their plans with the class. If evacuation is not recommended, the following safety tips are suggested. Stay indoors during the hurricane. Prepare a supply of water (the water supply may be shut off) and food for a few days. Power may also be lost during a hurricane. If the winds begin raging, the safest place to wait out the storm is in a room without any windows. Usually this is in a hallway or bathroom. More protection can be obtained by crawling under a mattress. Wait there until the storm is over. If the eye of the hurricane passes over, there will be a lull or a calm temporarily, and then the fury will begin again. Always remember, be cautious: a hurricane is an unpredictable force.

3. As a class activity, plot the track of a hurricane (if one happens to form) on the enclosed hurricane tracking chart. On the chart, list the name of the hurricane and the date it began. Then have the students listen to the news and report to the class the daily location of the hurricane. Plot it on the chart, using a dot. Above the dot place the date the hurricane was at that location. Connect the dots together with a line, depicting the path of the hurricane. Hurricanes have been named since the early 1950's. At first they had only women's names.

Suggested Procedure (Con't):

Today the names are alternated between men's and women's names. Each year the names start with the letter "A," and then continue on down the alphabet. Those people who have names starting with letters at the end of the alphabet may never have a hurricane named after them. They may be happy about this, especially if they live in an area prone to hurricanes.

3. Have the students fill in the worksheet "Hurricanes Happen Hurriedly" and discuss the answers with the class.

ANSWERS

1. **F** - Hurricanes begin over water that has been warmed to at least 82 degrees.

2. **T**

3. **T** - Ocean dwelling fish will move to deeper water when the presence of a hurricane is detected. It is thought that fish sense the change in barometric pressure. The danger is more pronounce for the shallow dwelling fish. The waters can get stirred up and clogged with silt after the hurricane passes through. This cuts the oxygen supply, and many fish die. The mullet, though, is able to survive in this murky water.

4. **F** - Hurricanes usually occur in August, September, and October. They sometimes appear as early as June or July, and as late as November.

5. **T** - Birds get trapped in the eye of the hurricane and cannot escape. It has been reported that they fly freely about in the eye, gathering food from the water as if nothing was wrong. They are moved along with the storm and may eventually break free when the storm dies out. This is how many pelagic (ocean going) birds end up over land. Some survive the storm, and some do not.

6. **F** - Hurricanes get their power from warm air. Cold air (or water) is usually what causes a hurricane to die out.

7. **T** - When winds reach 100 - 125 mph and trees are deeply rooted enough to remain standing, their bark usually blows off.

8. **F** - Hurricanes at their peaks usually range between 100 and 600 miles in diameter.

9. **T**

10. **F** - In a hurricane (unlike a tornado or water spout), the eye is calm, and the spinning winds surrounding the eye are the strongest force of the hurricane.

11. **T**

12. **T** - In the Northern Hemisphere, the hurricane, which is a low pressure system, spins counterclockwise (high pressure systems move clockwise). This is reversed in the Southern Hemisphere.

HURRICANES HAPPEN HURRIEDLY

NAME:_____ **DATE:**_____

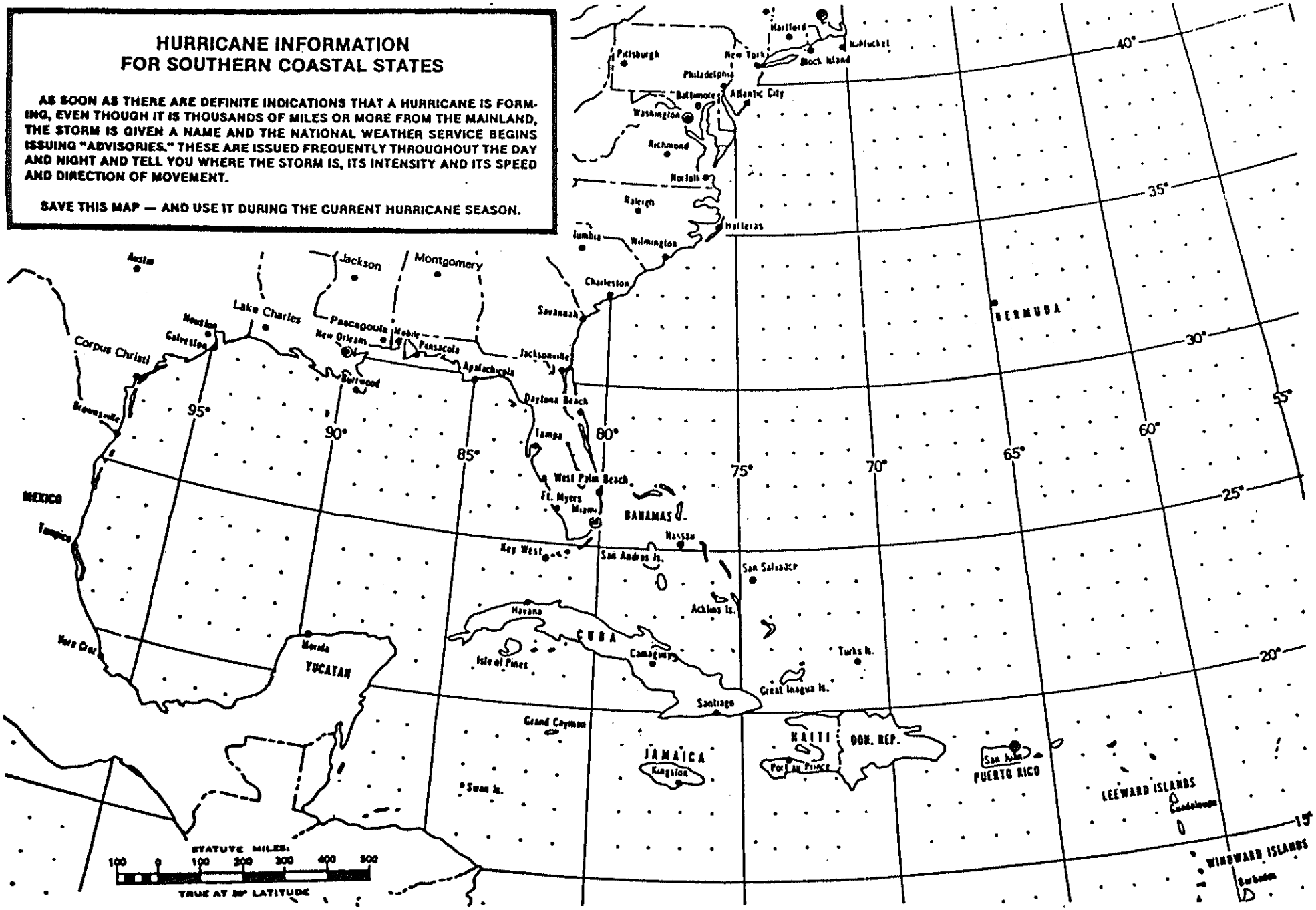
CIRCLE ONE ANSWER, TRUE OR FALSE FOR EACH STATEMENT:

1.	Hurricanes begin over land.	**T**	or	**F**
2.	A hurricane is also called a tropical cyclone.	**T**	or	**F**
3.	Some fish can detect an approaching hurricane.	**T**	or	**F**
4.	Hurricanes often happen in December.	**T**	or	**F**
5.	Birds that are trapped in the eye of a hurricane can fly around inside of it.	**T**	or	**F**
6.	Hurricanes get power from cold air.	**T**	or	**F**
7.	Hurricanes can blow bark off of trees.	**T**	or	**F**
8.	A hurricane doesn't usually get wider than 100 miles.	**T**	or	**F**
9.	In ancient Greek, cyclone means "coil of a snake."	**T**	or	**F**
10.	The eye of the hurricane is the most powerful part.	**T**	or	**F**
11.	In Australia, hurricanes are called "willy-willies."	**T**	or	**F**
12.	In the U.S., hurricanes spin counterclockwise.	**T**	or	**F**

HURRICANE INFORMATION FOR SOUTHERN COASTAL STATES

AS SOON AS THERE ARE DEFINITE INDICATIONS THAT A HURRICANE IS FORMING, EVEN THOUGH IT IS THOUSANDS OF MILES OR MORE FROM THE MAINLAND, THE STORM IS GIVEN A NAME AND THE NATIONAL WEATHER SERVICE BEGINS ISSUING "ADVISORIES." THESE ARE ISSUED FREQUENTLY THROUGHOUT THE DAY AND NIGHT AND TELL YOU WHERE THE STORM IS, ITS INTENSITY AND ITS SPEED AND DIRECTION OF MOVEMENT.

SAVE THIS MAP — AND USE IT DURING THE CURRENT HURRICANE SEASON.



THE ECOLOGICAL SYMPHONY

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: Fried Shrimp and Biloxi Bacon

Objectives:

To teach students about the food and energy cycles that occur in nature.

Materials:

* Sturdy paper (could be construction paper)
* Crayons or markers
* Glue stick or tape

Method:

Introduce the students to the main categories in which all living organisms are classified -- producer, consumer, scavenger, and decomposer. Talk about food webs and food pyramids. Discuss how the introduction of pesticides affects the natural world.

Background:

Every living organism is either a producer, a consumer, a decomposer or a scavenger. The producers are plants and algae that use energy from the sun to "produce" their own food. They are eaten by other organisms, called consumers. Consumers eat not only producers, but also other consumers. Humans are consumers, so are fish, raccoons, owls, and whales. When producers or consumers die, the decomposers and scavengers go to work. Decomposers are bacteria and fungi (mushrooms and their relatives) but do not include animals. Scavengers are animals that eat dead plants and animals. They do not usually eat consumers or producers. Some scavengers are beetles, worms, crabs, and vultures. Some consumers may also resort to scavenging at times. Examples are turtles, crows, rats and coyotes. The consumers are divided into the categories of carnivore, herbivore, insectivore, and omnivore. Carnivores are also called predators, and they eat other animals. Herbivores are plant eaters. Insectivores eat insects. Omnivores eat both plants and animals. Parasites are a special kind of consumer. Parasites do not kill their hosts outright, but rather live off of them, at the expense of the host. Mites, fleas, and leeches are parasites. Some animals may live on a host and not harm the host in any way. This is called a symbiotic relationship. It is common for the host to benefit by this relationship. Remoras are a type of fish that attach themselves very frequently to sharks. They eat the parasites that live on sharks, so both creatures benefit. In Africa, there is a bird that actually cleans crocodiles' teeth! The crocodile opens his mouth, and the bird climbs in for a hearty meal of food particles and leeches.

Suggested Procedure:

1. Discuss with the students the different classifications for plants and animals. Explain producer, consumer, decomposer and scavenger. Also discuss the further classification of consumers as carnivores, herbivores, insectivores, and omnivores. Once the terms have been explained, write the following columns on the blackboard:

Type of Organism	Type of Consumer
consumer	carnivore
decomposer	herbivore
producer	insectivore
scavenger	omnivore

Name a variety of organisms, one at a time, and ask the class to categorize them. Have the students tell you what type of organism you have named, and what it eats. If it is a consumer, have them tell you what type it is. Some possibilities are:

human being	-	consumer; plants and animals; omnivore
worm	-	decomposer; decaying plants and animals
vulture	-	scavenger; decaying animals
grass	-	producer; sunlight, water, and nutrients
bat	-	consumer; insects; insectivore
mushroom	-	decomposer; decaying plants
rabbit	-	consumer; plants; herbivore
flower	-	producer; sunlight, water and nutrients
fungus	-	decomposer; decaying plants
grasshopper	-	consumer; plants; herbivore
crab	-	scavenger; decaying plants and animals
tree	-	producer; sunlight, water and nutrients

2. Discuss parasitic and symbiotic relationships with the students. Once defined, ask them if they can think of any. Discuss the examples given in the background section, and add any others.

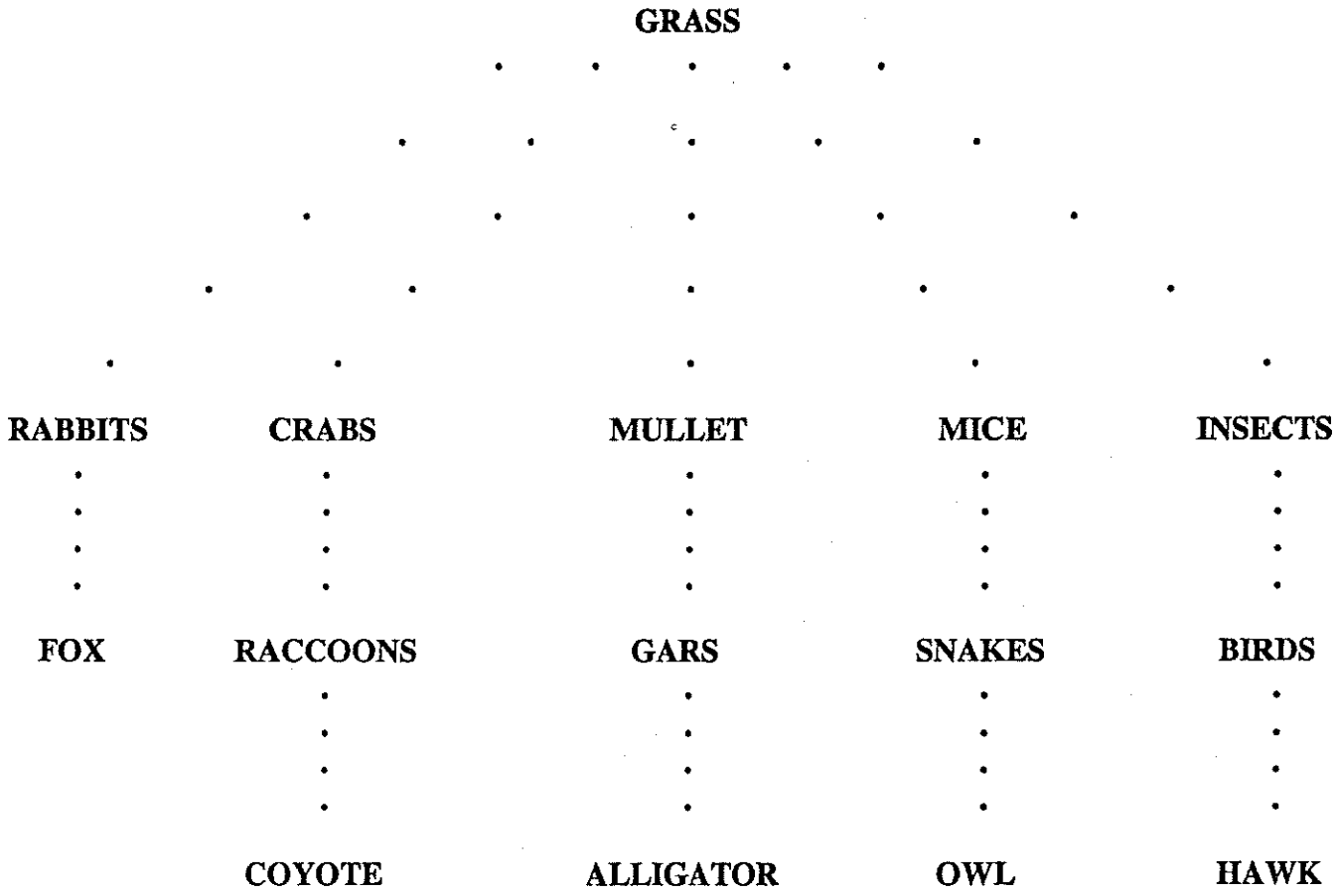
3. Discuss food pyramids with the students. Draw a food pyramid on the blackboard. A good example to use: grass, mice, snakes, owls. Draw the grass along the bottom of the pyramid because it is the most abundant of the four organisms. Mice come next, above the grass. There would be a lot of mice (maybe about 15), but not as many as there are grasses. Next draw snakes above the mice. There will be less snakes than mice (use about half as many). On the top of the pyramid, draw an owl. The pyramid is constructed this way to show what each animal eats, and what in turn eats it. In this system, the owl is the top predator. Discuss with the students the energy cycle. Energy is never used up or destroyed, just transferred from one organism to another. In the natural world, food is energy. Explain to the students

Suggested Procedure (Con't):

that plants get the energy they need from the sun. The mice in turn get their energy from the plants they eat. The snakes get the energy they need from the mice, and the owl gets its energy from the snakes (and perhaps the mice too). When the owl eventually dies, it too will be eaten. Decomposers and scavengers will get the energy they need from the dead owl. And so on and so on. Once the food pyramid is drawn, ask the students what would happen if one of the organisms was removed? The animals above would have to find something else to eat, or go hungry. The most prevalent food source in the pyramid is grass. Why do the students think this is so? What would happen if the grass had been sprayed with a pesticide? Suppose it wasn't strong enough to kill each individual mouse that ate it. What would happen to the owl? How many mice does the owl eat indirectly by eating snakes? Add up the number of mice shown in the food pyramid. Pesticide in the mice would build up in the owl, and over time it would probably kill it. That is why it is important to realize that pesticides and poisons don't just kill what they intend to; there are other victims.

4. Food webs are another way to explain the energy cycle. Put a list up on the blackboard of many different organisms that the students are familiar with. Have them cut up strips of paper approximately 1 inch wide by 9 inches long. On these strips, have the students write in large letters the names of the organisms listed on the board. Using glue or tape, have the students build a food web. Tell them that they need to begin their food web with a producer (make sure a plant, such as grass, is listed on the board) and to make a loop with the strip by affixing one end to the other. Then they continue along, affixing the next loop(s) through the first, and choosing an animal that would eat whatever the previous loop was. For instance, if three creatures eat the previous one, attach three loops to it. Loops are added until there are no more, or the final animal on the ends of each chain is a top predator (one that nothing else eats). The list on the following page can be used as an example. When putting the list on the board, mix up the order, so the students have to figure out what eats what. Once the food webs are made, ask the students who are the top predators? They will be found at the end of each chain of the food web. What would happen if one of the animals was removed from the web? The others would have to eat something else, or they would die. What is the one organism in the food web that no animal could survive without? It is the grass in this example (or whatever producer is chosen), because the grass feeds all the other animals either directly or indirectly. Where would human beings appear on the food web? They would occur at almost every loop!

FOOD WEB EXAMPLE



TOP PREDATORS: FOX, COYOTE, ALLIGATOR, OWL, HAWK

THE MARSH CONNECTION

Subject: Science
Duration: 3/4 hour
Location: Classroom
Related Activities: Marsh Soup

Objectives:

To teach students about salt marshes: what they are, and what they do.

Method:

Discuss the ecology of a salt marsh and the role that the salt marsh plays in our environment. Perform two experiments which show how salt marshes purify and filter the water that flows into them.

Materials:

* Washbasin
* Sponge
* "Dirty" water
* 2 cups
* Celery stalk
* Food coloring
* Water
* Knife

Background:

The salt marsh is the most productive ecological area in the world. It produces more nutrients in the form of organic matter than any other ecosystem. But at the same time, it is a fragile and easily destroyed habitat. Coastal development, water pollution, and industrial wastes threaten the existence of the salt marsh. Luckily, people have begun to realize how important these marshes are, and they are working to preserve and protect them.

The salt marshes we know today began forming after the end of the last ice age. Once the ice that covered much of northern North America retreated, and barrier islands, capes, and peninsulas formed along the coasts, salt marshes developed. Salt marshes cannot withstand the high pressure of direct hits by ocean waves, so they establish themselves only behind natural barriers. Islands, coves, capes, and peninsulas form such barriers. The first plant that moved into the area was Spartina alterniflora, better known as salt marsh cordgrass. Once it took hold, the marsh began to grow. The rhizomes (underground stalks) of the plant spread out and sent roots down into the sandy marsh bottom. As the plants grew thicker, they restricted the tide as it moved back and forth between their dense clumps. This began to trap sediment from the ocean, and the sandy bottom slowly grew into a muddy bottom. This build-up of sediment slowly raised the level of the marsh. Every year, the leaves of the plants died. The fallen leaves that were not washed out with the tides added to the muddy bottom a layer of peat. The foundation for the plants was now a mud and peat combination. Once the marsh had risen to the point where the waves reached the base of the plants, it remained at equilibrium. In the future, some erosion will occur, the sea level may change, and other factors may affect the growth of the marsh.

Background (Con't):

Juncus roemerianus, also known as black needle rush, will take advantage of the mud and peat platform built by the Spartina and move in. It needs some fresh water to survive, which it can get from rain or the creeks that drain into the marsh. It will not colonize the furthest edges of the marsh where the water is the saltiest, but it will come close. These two plants -- the Spartina and the Juncus -- are the dominant species in the Gulf Coast salt marshes.

Salt marshes are tidal. Some are formed in estuaries, where rivers or streams flow into the sea. Some are large, and some are small, but they all perform an amazing environmental task. They help to clean and purify the waters that flow into them. These wetland plants remove pollutants and excess nutrients from the water. They use whatever nutrients they can, and they store the pollutants in their tissues. This helps the animals that live in the marsh. But there is a limit to what a marsh, or any wetland can do. If these limits are exceeded, the marsh will die.

For more information on the salt marsh, see "Marsh Soup," "The Celebrity of the Marsh -- Grass," and "Creatures of the Marsh." In these sections, the elements and inhabitants of the salt marsh are discussed in detail. How the marsh contributes to the seafood industry is highlighted in the "Fried Shrimp and Biloxi Bacon" lesson.

Suggested Procedure:

1. Discuss salt marshes and their environmental impact. Have the students ever seen a salt marsh? Ask them what it was like. What were the sights, smells, and sounds?

2. Tell the students how the plants in wetlands help to remove pollutants and excess nutrients from the water. Explain that there is a limit to this filtration system, and it is important not to overload it with fertilizers, pesticides, and other pollutants. Whatever people put on their lawns eventually gets into wetlands. Rain and water runoff move the poisons along through water systems until they make their way out to the sea. Once there, compounded by all the other poisons, the combination can be deadly. Brown pelicans and ospreys were almost eliminated from the Gulf Coast by the pesticide DDT. Once DDT was banned, the birds made a slow comeback and are now seen along the coast. How did the DDT affect the birds? Did it kill them directly? No, it was indirectly through the fish. The fish ingested the poison, and the birds ate the fish. The poison in the fish did not kill the birds, but it affected the birds' eggs. The eggshells became so weak that when the parent birds sat on the eggs, they broke. After a while, there were no new pelicans or ospreys being born. Once the older birds died, there were no young left to replace them. People missed the birds and worked to find a solution. The a solution. The banning of DDT was a great success story not only along the Gulf Coast, but all over the United States.

Suggested Procedure (Con't):

To show how marshes and other wetlands help to purify the water that flows into them, perform the following experiments:

Wetlands are Filters

Using a washbasin and a large sponge (the sponge needs to be elevated in some manner so that it is not sitting directly in the water that remains), pour slowly into the sponge water that is mixed with mud. Discuss the results with the class. Then continue to pour "dirty" water through the sponge until it cannot filter any longer, and the particles begin to flow into the rest of the water. Discuss the outcome with the class. Ask if the students have any conclusion to draw from this experiment. Explain that marshes are very good at cleaning their environment, but they have a limit. If we overwork our marshes, they will no longer function properly and may die.

Plants Absorb Pollutants

Add a few drops of food coloring to a cup of water. Cut off the bottom part of a stalk of celery, and place it in the water. Tell the students that the food coloring represents pollutants in the water, and the celery represents a wetland plant. Leave the celery overnight and finish the experiment the following day. Remove the celery from the water and cut it into pieces. Show the students the pieces of celery; the food coloring will be evident in the cross-sections. Explain that this is how plants remove toxic substances from the water. Ask them to imagine an entire marsh filled with plants that can absorb these pollutants. Do the plants have limits to what they can do? Of course, they can only absorb some of these chemicals. Once the plants die, the toxic substances can be re-released into the water. Some substances may be converted into harmless ones by the plants. Others remain toxic. Ask the students if they can think of any solutions to this problem? Reducing and eliminating the use of chemicals, poisons, and other toxic substances is the best solution. Begin at home -- don't over-fertilize your lawn, or better yet, don't fertilize it at all! Try not to use pesticides; these chemicals are deadly, not only for the insects they are aimed at, but for other unsuspecting creatures as well. Don't pour oil into the ground, take it to a recycling center where it will be reused and it won't pollute. Students can educate their parents and friends by teaching them about wetlands -- what fragile and productive environments they are.

CELEBRITY OF THE MARSH -- GRASS

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: Marsh Soup, Fried Shrimp and Biloxi Bacon

Objectives:

To teach students about the plants that grow in Gulf Coast salt marshes.

Materials:

* Pencils
* Paper

Method:

Basic plant structure will be discussed as well as the adaptations plants need to grow in a salt marsh. A game "Are We Eating Grass?" will be played to show students that grasses and other plants supply us with the food we eat.

Background:

Salt marsh ecology is discussed in detail in the section "The Marsh Connection." An understanding of what a salt marsh is is necessary to continue with this lesson.

Along the Gulf Coast, hundreds of plants of different sizes, shapes, and colors grow in forests. Yet in the salt marsh, which may be a short distance away, only two primary plants flourish. The salt marsh is an extremely hostile environment to live in if you are a plant. The sun beats down on you all day long, heating your stalks and leaves. The tide comes in and surrounds you with salty or brackish (part salt, part fresh) water. You need fresh water to drink, and none is available (except rainwater at times). What's a plant to do? This is where Spartina alterniflora, or salt marsh cordgrass, and Juncus roemerianus, or black needle rush, make their appearance. They have special adaptations that allow them to survive where others cannot. Spartina can withstand even more salinity than Juncus, which makes it the leading star, appearing solo times. Both plants have learned to deal with the rigors of salt marsh life. Spartina has a unique way of obtaining water for survival. It maintains within its cells a salt water solution of higher salinity than the water in which it grows. When the salt water from the marsh is taken in through its roots, an amazing process takes place. It is called osmosis. Water from the marsh moves through membranes in the roots of the plant, leaving behind most of the salt, causing "fresh" water to flow into the plant. The excess salt that enters the plant is expelled through glands along the leaves. When the sun shines over the salt marsh, the leaves of the Spartina sparkle with the white crystals. Using this method, Spartina can actually "drink" the salt water. Juncus on the other hand needs brackish water in order to survive. Spartina

Background (Con't):

is a grass, and Juncus is a rush. Spartina has long leaves which grow out of divisions in the stalk called nodes, and is a bright green color. Juncus is a cluster of long, cylindrical blades with sharply pointed tips (hence the name needle rush). It is dark green in color, almost black. Both of these plants produce flowers. They are also perennials. Each year, the leaves die and fall into the marsh. This process is vitally important to the salt marsh. The dead leaves are washed into the water by returning and receding tides. There they become part of the detritus (decaying organic matter) that animals in the marsh feed on. The amount of organic material produced by one acre of salt marsh in one year can be up to ten tons! An acre of good inland hayfield in one year will only produce about four tons of organic material. The salt marsh is one of the most productive habitats per acre in the world, and it provides food and shelter for much of the seafood we consume.

Suggested Procedure:

1. Discuss with the students the major parts of a plant -- roots, stalk, leaves, flowers. Ask them what the needs of a plant are? Sunlight, nutrients, and water. Plants use sunlight along with chlorophyll to convert water and carbon dioxide into sugars which feed the plant. Chlorophyll is what gives plants their greenish coloration and also allows them to perform photosynthesis.

2. Ask students how many plants exist in the forest? Define a salt marsh. Then ask them to compare the plants in a forest to the plants in a salt marsh. Why do they think there is a difference? Discuss the salinity of the marsh, and explain that salt kills most plants. Tell the students about the two plants on the Gulf Coast that can survive under high salinity conditions. They are salt marsh cord grass (Spartina alterniflora) and black needle rush (Juncus roemerianus). The Spartina is much more tolerant of salt than the Juncus. Juncus must have some brackish water in order to survive. Once the salt water becomes mixed with fresh water, many other plants will grow. Some of these are salt meadow hay, marsh hibiscus, duck potato, yellow pond lily, button bush, arrow arum, widgeon weed, and swamp milkweed.

3. Have the students play the game "Are We Eating Grass?" Ask the students to write down everything that they ate for dinner the previous evening. Then ask them to trace the history of where each item of food came from, and what that item ate for survival. For example, if milk was listed, the answer would be "milk came from cows and cows eat grass." Have the students write down the item they ate on the left, and then separate the related animals and food sources with arrows. Example: milk --> cows --> grass. Have them break down each item in this way. If an animal eats another animal, have them show that the prey animal has eaten plants, or that it ate something that ate plants. The results will show that we depend upon plants, and especially grasses, for our sustenance.

ARE WE EATING GRASS?

The following table lists many food items that might be used in this lesson.

CHICKENS	-->	grains	=	**grasses**						
HAMBURGER STEAK HOT DOGS	-->	cows	-->	**grasses**						
PORK CHOPS BACON SAUSAGE	-->	pigs	-->	slops*	=	corn rice milk	= = -->	grain grain cows	= = -->	**grasses** **grasses** **grasses**
						potatoes			=	**plants**
FISH	-->	phytoplankton	=	**algae**						
	-->	zooplankton	-->	phytoplankton	=	**algae**				
	-->	smaller fish	-->	plankton or decaying **plants**						
	-->	decaying **plants**								
SHRIMP CRABS LOBSTER OYSTERS	-->	phytoplankton zooplankton decaying **plants** decaying animals	= -->	**algae** phytoplankton	=	**algae**				
				(that could be traced to have eaten a plant eater)						
BREAD RICE PASTA	=	grains	=	**grasses**						
POTATOES TOMATOES BROCCOLI LETTUCE CAULIFLOWER EGGPLANT SQUASH	=	**plants**								
BUTTER CHEESE MILK ICE CREAM YOGURT	-->	cows	-->	**grasses**						
CAKES	=	sugar, grains	=	**grasses**						
PIES	=	fruits, grains	=	**trees, grasses**						

* Slops may also contain meat products, which can be traced back to plants.

MARSH SOUP

Subject: Science
Duration: 1/2 hour
Location: Classroom
Related Activities: The Marsh Connection, Fried Shrimp and Biloxi Bacon, and Celebrity of the Marsh -- Grass

Objectives:

To teach students about the water in a salt marsh, and how it provides many creatures with their sustenance.

Materials:

* Copies of worksheet
* Pencils

Method:

Discuss with the students what makes "marsh soup." Explain what plankton and detritus are. Students will fill in the blanks on the "Marshes Are Marvelous" worksheet.

Background:

The water in a salt marsh sustains life for many marsh inhabitants. It provides food and nutrients to young and adult shrimp, crabs, fish, and mollusks. It does this by offering its "marsh soup" to any interested takers. Gulf Coast marsh soup is made with water from the Gulf of Mexico, salt included. Next, the vegetables are added. Dead and decaying plants fall into the water from the salt marsh including salt marsh cordgrass and black needle rush. Phytoplankton is washed into the marsh with the water from the Gulf. It contains diatoms (single-celled algae) and dinoflagellates (plants that can propel themselves). Now the meat products can be added. Zooplankton drifts in with the tides and currents from the Gulf, and decaying animal matter washes in from shore or develops when animals die in the water. Then to spice the whole mix up, bacteria come in to feed on the decaying organic matter and end up in the soup, too. All these ingredients combine to form "marsh soup" that is better than mom could make (according to the marsh inhabitants, anyway).

Suggested Procedure:

1. Discuss with the students the recipe for life in a salt marsh: "marsh soup." Explain terms that they are not familiar with such as plankton or detritus. Plankton is a combination of zooplankton (animal plankton) and phytoplankton (plant plankton). Detritus is the combination of decaying plants and animals in the water. Tellthe students that marsh soup sustains a vast

Suggested Procedure:

amount of marine life that in turn supports other life as well. Shrimp, crabs, fish, and mollusks (oysters, clams, and mussels) are eaten not only by other marine creatures, but by birds and mammals, too.

2. Have the students fill in the blanks in the "Marshes Are Marvelous" worksheet. The answer is given below each blank with the letters jumbled. The students can fill in the answers if they know them, or unscramble the letters if they don't. After the students have filled in their worksheets, discuss the answers with the class.

Marshes Are Marvelous -- Answers

1. soup
2. mullet
3. shrimp
4. oysters
5. plankton
6. zoo
7. animal
8. plant
9. water
10. people
11. salt marsh

MARSHES ARE MARVELOUS

NAME: _____ **DATE:** _____

1. The water in the salt marsh is sometimes referred to as marsh _____.
   o u p s

2. _____ and menhaden are common fish in the salt marsh.
   u m l l t e

3. _____ live in the salt marsh until they are adults and then
   p h r i m s
   they move out into the Gulf of Mexico.

4. _____ filter food out of the water, which means that they
   e r s t o y s
   are filter feeders.

5. _____ are moved all around by tides and currents.
   t o n l a n k p

NAME: _____ **PAGE 2**

6. **Plankton is made up of phytoplankton and** _____ **plankton.**
o o z

7. **Zooplankton is** _____ **plankton.**
m a l a n i

8. **Phytoplankton is** _____ **plankton.**
l a n p t

9. **Detritus is made up of decaying plants and animals and is found in the** _____.
r a t e w

10. **Lots of animals eat the creatures that live in the salt marsh including** _____.
o e p p l e

11. **The** _____ _____ **is a very busy place!**
t a l s h a r m s

FRIED SHRIMP AND BILOXI BACON

Subject: Science, Social Studies
Duration: 1 hour
Location: Classroom
Related Activities: The Ecological Symphony, Marsh Soup

Objectives:

To explain to students the valuable interconnection between salt marshes and the Gulf Coast seafood industry.

Materials:

* Index cards
* Magic markers
* Brightly colored yarn
* Masking tape

Method:

Discuss with students how salt marshes help to feed and protect young shrimp, fish, and crabs that live in the Gulf of Mexico. Discuss the seafood industry along the Gulf Coast. A game, "Marsh Munchies," will be played to show how all inhabitants of the salt marsh are interconnected.

Background:

The salt marsh has been called the most productive habitat in the world. The primary reason the marsh is so valuable is its production of organic matter. The organic matter comprises both plants and animals, alive and dead. The dead plants and animals make up a very large part of the food supply for marsh inhabitants. When decaying matter ends up in the water, it is called detritus. Detritus feeds a variety of marine organisms including shrimp, crabs, mollusks and fish. Some of these creatures spend their entire lives in the marsh. Others reside in the marsh during the early part of their lives but eventually move out to the deeper waters of the Gulf of Mexico.

This is how the shrimp, crabs, and fish (such as menhaden and mullet), that are eventually caught in the Gulf, develop. The salt marsh is a nursery to these growing youngsters. It provides them with their basic needs of food and security. The water in the marsh, filled with organic matter, provides the ideal nutrition. Protection is also available in the marsh where predators are fewer than in the Gulf.

The fish, shrimp, and crabs develop in the salt marsh and then head out to the open Gulf. Here they are food for a great number of animals, including humans. Not only do these creatures feed people along the Gulf Coast, but they are also shipped around the country as food and other products.

Suggested Procedure:

1. Discuss with students how shrimp, crabs, and fish develop in the salt marsh. Explain that the marsh serves as a nursery taking care of these young fry. Compare the needs of a human baby in a nursery (warmth, milk, security) to those of the shrimp, crabs, and fish (warm water, "marsh soup", and protection from the elements and predators). Discuss how the marsh provides the things that the young animals require to develop. Also discuss how these shrimp, crabs, and fish in turn become food for other creatures of the sea and shore, including people. We need the salt marsh to provide food for us as well as for other creatures. Ask the students if they eat shrimp, crabs, or fish from the Gulf. Remind them that it is very important to know that what goes into the marsh, eventually goes into us, too!

2. Discuss with the students the different industries that are supported by the Gulf. What are their products? What would happen if there were no regulations on when and how much the industries take from the ocean? Explain what overfishing means, and how wildlife management techniques can be used in order to insure that there will always be shrimp, crabs, and fish in the Gulf of Mexico. Guidelines are set by "seasons" and this outlines when certain animals can be taken, and when they can't. This gives the animals a chance to rebound and repopulate. Some animals can only be caught if they are over a certain length. This is another management technique used frequently to assure that a species is not eliminated.

3. Play the "Marsh Munchies" game. Students will act out a food web about the marsh and learn how everything that lives in the marsh is delicately interconnected. Cut up three foot sections of yarn, one for each student. Using the following list as an outline, write the names of the animals and elements on index cards. Write on the bottom of each index card, in parentheses, what each animal eats or needs for survival. Make sure that there is one card for each student. Other animals can be added if necessary. The cards with "water," "sun," "cordgrass," "detritus," and "plankton" are important foundations for the food web and must be used in every game.

   Hand out the cards and yarn to the students. Have the students tape the index cards on themselves, so the other students can read them. Define any items that the students may not understand, like detritus (decaying animals and plants -- especially cordgrass). Space may need to be cleared in the classroom for the rest of the activity.

   Tell the students that they are going to build a salt marsh food web. Begin the food web with "water," the basic element (nothing could live without water). Whoever has the "water" card will stand at the front of the room, and in the center. Next to "water" comes the "sun" which shines on the water. Have the "sun" stand in front of the water. The "water" and "sun" will each hold the end of one piece of yarn. Ask the students, "Who needs sun for food production?" Plankton and cordgrass do. Have the "plankton" and "cordgrass" line up, side by side, in front of the "sun." This is the producer level. The producers are food for all the

Suggested Procedure (Con't):

other animals in the game, and they need the "sun" and "water" in order to exist. Each of the producers gives the "sun" one end of his or her piece of yarn and holds on to the other end. Now ask the class, "What is formed when cordgrass and other organic material end up in the marsh?" Detritus is formed. Have the "detritus" stand in front of the "cordgrass," with a piece of yarn joining the two. The "detritus" and "plankton" make up the primary source of nutrition in the salt marsh. In the marsh, these two intermix, and animals that feed on one or the other, usually end up feeding on both. Now ask the class, "Who out there eats plankton or detritus?" All the animals that feed on these organisms will line up in front of either the "plankton" or "detritus," giving one end of their yarn to the food source they chose. Try to divide them equally to make room for the next level of consumers. Continue this procedure along each level, until all the students have a place in the web.

Once the food web is assembled, ask the students what they are all dependent upon. Water, sunlight, and the producers are required for everyone. Each individual animal's needs are more specific. Ask the students what would happen if a lot of pollutants were dumped into the water. Choose a producer (plankton or cordgrass), and tell the class that it has been contaminated or destroyed by pollution. The animals who are attached to that producer have to drop their string and sit down. Their food supply has been cut off, and they have died because they have nothing to eat. Then each level attached to those animals will have to do the same, until one whole part of the web is "dead." Explain that this is why it is very important to protect marshes (and other wetlands as well). Now tell the students that people have realized what happened to the salt marsh and have stopped the pollution that was killing the marsh. Slowly, the producer that was killed off would begin to grow again. Have the producer stand up and reconnect to the "sun." Then the consumers that fed on the producer would return to the marsh. And so on and so on along the food web. Have each item stand up one at a time as they come back to feed in the salt marsh again. Explain to the students that the web of life in the salt marsh, as well as other ecosystems, is a very fragile balance that we can help preserve.

MARSH MUNCHIES

WATER		
SUN		
PLANKTON	-	Needs sun and water
CORDGRASS	-	Needs sun and water
DETRITUS	-	Formed from decaying animals and plants (cordgrass)
BLUE CRAB	-	Eats detritus/plankton
FIDDLER CRAB	-	Eats detritus
MARSH DUCK	-	Eats detritus
MULLET	-	Eats detritus/plankton
MENHADEN	-	Eats detritus/plankton
SHRIMP	-	Eats detritus/plankton
OYSTER	-	Eats detritus/plankton
TERRAPIN (TURTLE)	-	Eats blue crabs
KILLIFISH	-	Eats shrimp
TERN (BIRD)	-	Eats shrimp
CLAPPER RAIL (BIRD)	-	Eats shrimp
OYSTER FISH (GULF TOAD FISH)	-	Eats oysters
FLOUNDER	-	Eats killifish
REDFISH	-	Eats blue crabs
WHITE TROUT	-	Eats mullet

MARSH MUNCHIES (CON'T)

GAR	-	Eats menhaden
DOLPHIN	-	Eats mullet
HERON (WADING BIRD)	-	Eats menhaden
OSPREY (FISH HAWK)	-	Eats mullet
KING MACKEREL	-	Eats menhaden
BLACK DRUM	-	Eats oysters
RACCOON	-	Eats fiddler crabs
COBIA	-	Eats white trout
ALLIGATOR	-	Eats gars
SHARK	-	Eats black drum

NOTE: Only one food item was listed for each animal in order to simplify the game. In reality, some of these animals may eat many other things.

CREATURES OF THE MARSH

Subject: Science
Duration: 3/4 hour
Location: Classroom
Related Activities: The Ecological Symphony

Objectives:

To teach students about some of the inhabitants of the Gulf Coast salt marshes.

Materials:

* Copies of worksheet
* Pencils

Method:

Discuss with the students some of the creatures that inhabit the salt marsh. On a worksheet, the students will match food items found in the marsh with the animals that eat them.

Background:

The salt marsh overflows with life when it awakens to greet the morning sun. The red-winged blackbirds fly over the marsh singing "tonka-ri, tonka-ri." The fiddler crabs come out of their burrows, as the tide recedes, to eat a breakfast of detritus. Clapper rails move about within the thick salt marsh cordgrass and black needle rush, uttering cries of "kek-kek-kek-kek-kek" as they go. One clapper rail can excite many others into responding, and an unusual harmony echoes throughout the marsh. Least terns hover over the water on quick wingbeats, and then like daredevils crash on the surface of the water. Quickly they alight, if they are lucky with shrimp or small fish in their bills. In the water, blue crabs swim gracefully to and fro searching for meals to satisfy them. Anything dead will do, or something alive if they are fortunate. Further down the winding bayou, an alligator floats motionlessly. Its eyes and nostrils are the only clues to its ominous presence. As a green heron flies in, it gives a harsh "skeeow" and lands along the edge of the cordgrass to look for fish. The alligator slowly approaches the heron, which is hunting intently, and the water barely stirs. A least bittern makes a rapid flight from one cluster of cordgrass to another. This startles the green heron, who gives another "skeeow" in disgust, and flies off to a quieter location. The alligator retreats. Back in the needle rush a small brown bird is seen clinging to a windblown stalk. It sings a rattling, mechanical song that, in human ears, evokes a sense of simplicity in life. The bird is a marsh wren, and it is catching insects to feed its young. Marsh periwinkles move slowly down the cordgrass stalks to graze in detritus lying on the mud. They will return to their high refuges when the tide comes in. In the mud, the distinctive paw prints of a raccoon tell the story of a nighttime meal of fiddler crabs. A mullet jumps gracefully out of the water. The splashing sound it makes when it lands back in the water causes the clapper rails to call as if in response to some danger. An osprey flies over the marsh

Background (Con't):

beating its long wings with a lumbering consistency. The wind rustles through the marsh, gently blowing the water, cordgrass, and black needle rush. The tide turns. Slowly, water starts to migrate back into the marsh. The marsh periwinkles and fiddler crabs begin their treks homeward, and the red-winged blackbirds call "tonka-ri, tonka-ri."

The salt marsh is filled with many creatures coexisting in this unique world of water and plants. Some, like the clapper rail, may spend their entire lives in the marsh, never leaving it. The amount of life a salt marsh sustains is amazing. See "Fried Shrimp and Biloxi Bacon" for more information about salt marsh inhabitants and their importance to the seafood industry.

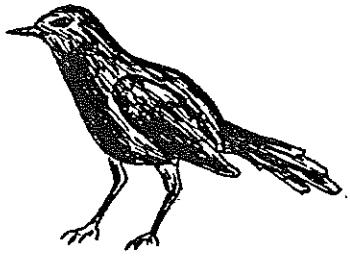
Suggested Procedure:

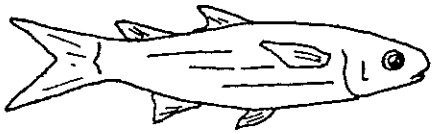
1. Discuss with the students some of the creatures that live in the marsh. Have them tell you any animals they know that live in the marsh. Do they also know what these animals eat, or what in turn eats them? Some of these creatures have interesting adaptations to marsh living. Fiddler crabs dig burrows. They come out at low tide to feed and return to their burrows with the high tide. Clapper rails (long legged wading birds that slightly resemble chickens), also called marsh hens, build hammock type nests to keep their young high and dry in the marsh. Alligators hunt using periscopes (eyes on top of their heads) and snorkels (elevated nostrils) to sneak up unseen (they hope) on their prey. Marsh periwinkles "commute" to work each day, sliding down the cordgrass stalks as the tide goes out, and crawling back up before it returns. Down below in the mud, they feed on detritus. If the students can think of additional animal adaptations, have them share their ideas with the class.

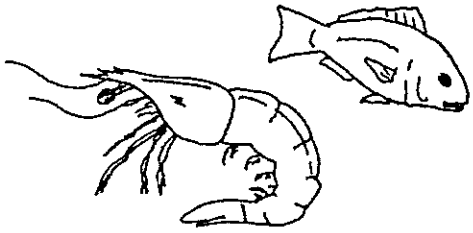
2. Discuss with the students adaptations that animals have for feeding. Long bills can be used to catch worms, fish, or shrimp. Tiny bills are for catching insects. Teeth are necessary in order to eat other animals. A creature without teeth may be a filter feeder or a scavenger. Knowing these facts, it is not hard to determine what a marsh animal might eat. Using the enclosed worksheet, have the students try to match the pictured animals with the food(s) they eat. Have them draw lines from the animal to its food. If an animal eats more than one item, they can draw more than one line. After the worksheets are completed, discuss the answers with the class. Have the students ever seen any of these animals? If so, what were they like?

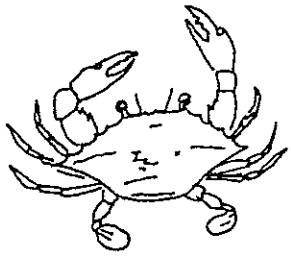
MARSH MEAL MATCH-UP

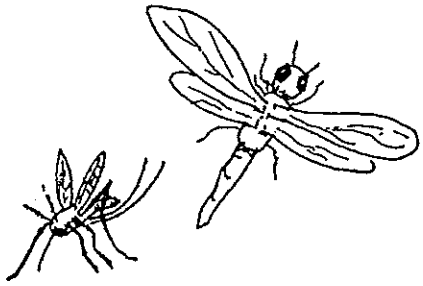
Draw a line from each animal on the left to the food it eats on the right. If it eats more than one food you can draw another line.

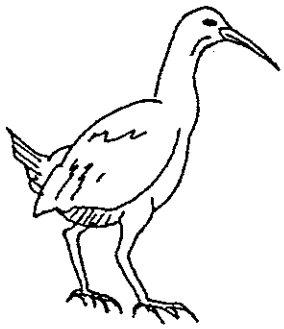


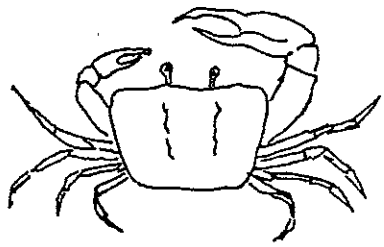






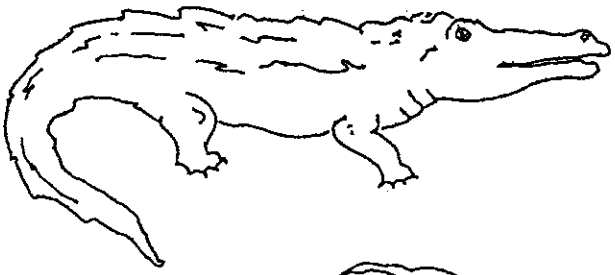


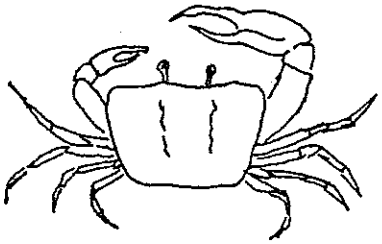


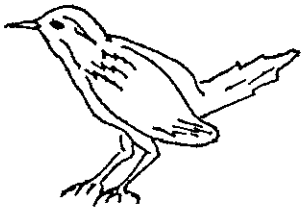


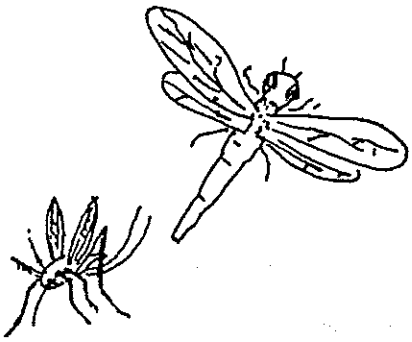
MARSH MEAL MATCH-UP

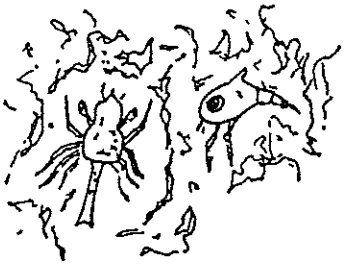
Draw a line from each animal on the left to the food it eats on the right. If it eats more than one food you can draw another line.

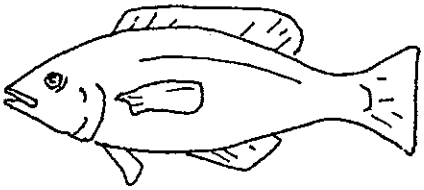












MARSH MEAL MATCH-UP

ANSWERS

Red-winged blackbirds	-	have small bills and eat insects
Mullet	-	have no teeth and eat detritus and plankton
Blue crabs	-	have no teeth and eat detritus and plankton
Raccoons*	-	have teeth and eat crabs, shrimp, and small fish
Clapper rails	-	have long bills and eat shrimp and small fish
Alligators*	-	have big teeth and eat blue crabs and large fish
Fiddler crabs	-	have no teeth and eat detritus and plankton
Ospreys	-	have hooked bills and talons and eat large fish
Shrimp	-	have no teeth and eat detritus and plankton
Marsh wrens	-	have small bills and eat insects

* Alligators and raccoons are opportunists and in reality would eat whatever they could catch.

TOP DOG -- THE ALLIGATOR

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: What Good Are Sharks Anyway?

Objectives:

To teach students about the need for predators in the environment. To discuss the alligator specifically.

Materials:

* Paper
* Pencils

Method:

Discussion about the alligator and its status as the top predator in its community. Explain predator and prey relationships, especially as related to the alligator. Play "Bayou Bingo" to learn more about the alligator's food, habitat, behavior, and adaptations.

Background:

Predators are at the top of the food chain because they eat other animals and are not generally eaten by other predators. Sometimes, though, predators do eat other predators. A large owl will at times eat a smaller owl. A coyote may eat a fox. A king snake will eat a rattlesnake. Predators are absolutely essential to maintain a healthy environment. The predator usually gets the slower, weaker, or diseased animals, while the faster, smarter, and healthier animals escape. When breeding time comes, the "cream of the crop" among the prey animals are left to raise young and pass along their genes.

An alligator may live in a variety of habitats, ranging from islands, to coasts, to marshes, to rivers. Wherever it chooses to live, the alligator is the top predator. It eats basically anything that it can catch. The alligator has an elongated jaw with many crooked and pointed teeth. These help it to grasp and devour its prey. One way the alligator hunts is to act like a floating log, eyes and nostrils above the water, waiting for an unsuspecting animal to pass by. Another method is to slowly and stealthily sneak up on its prey. This type of hunting requires great patience. The alligator is a very spectacular looking beast. Its scales rise up along the ridges of its back as if they were armor, ready to protect it from some type of prehistoric dinosaur. But you may ask, what could eat an alligator? Actually, relatives of today's alligators date back to a time when dinosaurs did roam the earth. So at one time, they were not the top predators! Alligators, which are reptiles, are cold blooded. This means that in order for an alligator to have enough energy to move around, catch a meal, or digest its food, it must "thermoregulate." An alligator cannot control its body temperature internally. It

Background (Con't):

must be sufficiently warmed or cooled by its environment in order to function properly. When it is too cold, an alligator needs to bask in the sun's rays for heat. When it is too hot, an alligator must seek shady and cool areas. Don't let an alligator fool you, though. It can run as fast as a person when it wants to. Mother alligators are very protective of their nests and will chase most intruders away. Reptile eggs are very fragile and, unlike birds' eggs, are not turned. If reptile eggs are turned over, the young inside would drown in the liquid that they were previously floating on top of. When the baby alligators hatch, they instinctively go toward the nearest water for food and safety. The young alligators are immediately independent and ready to take care of themselves. Once they are in the water, the babies and mother will usually go their separate ways.

Suggested Procedure:

1. Discuss with the students some of the interesting information about alligators. Talk about habitat, adaptations, behavior, and food. Ask the students if they have ever seen an alligator. What did they observe about the alligator? Define the term "predator" and ask the class why predators are important. Discuss how predators keep the prey population healthy and strong by eating the sick and weak animals. Of course, sometimes a healthy animal gets taken by surprise, but this is usually the exception and not the rule.

2. Play "Bayou Bingo" with the students. Each student will need to draw a bingo card by making five rows and four columns of empty squares on a piece of paper. Along the top of each of the four columns, have the students write "Food," "Habitat," "Behavior," and "Adaptation." Along the left side of each row, have the students write the following letters. Row 1 -- "G," Row 2 -- "A," Row 3 -- "T," Row 4 -- "O," and Row 5 -- "R." Using the "Bayou Bingo" handout, call out loud, one at a time, each of the contents of the squares. The students will have to determine where on their card the item belongs. Each item will begin with one of the letters along the left side of the rows. It will also be either a "Food," a "Habitat," a "Behavior," or an "Adaptation" of the alligator. Give the students time to locate the proper position of the item on their cards. Then call the next square (in a random order). Continue until all of the squares have been used. An example could be given to class to demonstrate the game. If "Thick Skin" was chosen, it would go under "Adaptation" and across from "T." Once the cards have been filled in, discuss the answers with the class.

BAYOU BINGO

	FOOD	HABITAT	BEHAVIOR	ADAPTATION
G	GREEN HERONS	GULF ISLANDS	GLIDING IN WATER	GREAT BIG TEETH
A	AMPHIB-IANS	A BURROW	ASHORE BASKING	A LONG JAW
T	TURTLES	THE MARSH	TRYING TO CATCH DINNER	THICK SKIN
O	OPOSSUMS	OCEAN COASTS	OPENING JAWS	OUTER BODY HAS SCALES
R	RABBITS	RIVERS	RESTING IN SHADE	RAISED EYES

IN THE AIR -- BIRDS!

Subject: Science
Duration: 1 hour (each activity)
Location: Classroom and Outdoors
Related Activities: Creature Features

Objectives:

To teach students basic bird structure, classification, and behavior.

Materials:

* Paper
* Pencils
* A bird identification guide

Method:

Discuss with the students the parts of a bird and the different types of birds that exist. Bird adaptations and behavior will be discussed also. Take the students outside for a bird observation walk.

Background:

Birds are the lords and ladies of the air, able to feel the wind flowing freely past their wings as they head skyward, moving from one destination to another. Some of these birds are the most beautifully colored animals in all of nature. Color is an adaptation and so is voice. Songbirds sing lovely and melodious songs during courtship and as territorial warnings. Birds eat a variety of foods including berries, seeds, grasses, nectar, insects, fish, other birds, and mammals. Birds have features that allow them to feed in different ways. They may have long bills, short bills, thin bills, wide bills, hooked bills, straight bills, big bills, or little bills. Other adaptations are long legs, short legs, tiny claws, big claws, round wings, pointed wings, stiff feathers, and soft feathers. All these parts combine to make very different types of birds. Birds can be categorized into about eight groups: the swimming birds (ducks, geese, loons, etc.), the aerial divers (pelicans, gulls, terns, etc.), the wading birds (egrets, herons, ibises, etc.), the shorebirds (plovers, sandpipers, etc.), the chicken-like birds (grouse, quail, turkey, etc.), the birds of prey (eagles, falcons, hawks, owls, etc.), the passerines -- songbirds and perching birds (warblers, thrushes, finches, sparrows, etc.), and the non-passerines -- non-singers and non-perchers (doves, hummingbirds, kingfishers, woodpeckers, etc.). Within each group, birds are further divided by family, and by species. Birdwatching has become an international hobby, and books are available for identifying birds anywhere in the world. Gulf Islands National Seashore publishes a list of all the birds that have been seen in the park, and it is included in the appendix.

Suggested Procedure:

1. Discuss with the students the parts of a bird. Draw a picture of a bird on the blackboard, and label the following parts: bill (upper and lower mandible), forehead, crown (top of the head), nape (back of the neck), back, rump, tail, eyes, throat, breast, belly, side, wings, legs, toes, and claws. Discuss these features with the class, and ask them what similar features humans have. Everything on a bird would have a counterpart on a human, except the tail. Ask the students what the functions are for the different parts of a bird. Wings are used for flight and for covering things up (like young in the nest, or a recently caught meal); the tail is used as a rudder, and for stabilizing the bird; the bill is used to capture and eat food; the feet are used for grasping or clinging.

2. Discuss the different types of birds with the students. What birds have they seen? Using the enclosed list, try categorizing some of the birds seen by the students. Ask the students to describe the most beautiful birds they have seen, the most interesting behaviors they have observed, and the bird songs and calls that they have heard. Discuss bird adaptations with the class. Ask them what purposes coloration may serve? Coloration helps some birds to camouflage themselves (eg. sparrows), while it may help other birds (such as the brightly colored cardinal) to attract mates. Ask the students how they think the shape or size of a bill affects what a bird eats? Long and thin bills are used for probing the mud and sand for invertebrates, tiny bills are used for picking insects out from under bark and leaves, wide and short bills are used for cracking seeds, wide and long bills are used for catching fish, and hooked bills are used for tearing flesh. Ask the students about different types of feathers. Discuss the long flight feathers, called primaries, the stiff tail feathers, and the small contour and down feathers that cover the body. Some birds have softer flight feathers than others. Ask the students why they think this might be so. Explain that some birds, like owls, need to sneak up very quietly on their prey, so they have soft feathers that don't make any noise. Other birds, like pelicans, gulls, or vultures have stiff feathers that make a lot of noise when they fly. It is not important for them to sneak up quietly, because their food is either under water, or dead. Hummingbirds have stiff noisy wings that actually hum because they are moving so fast! This is fine for the hummingbird, whose principle foods are nectar and insects. Hummingbirds have speed on their side and can move in any direction, even backward, to catch an insect, visit a new flower, or avoid a predator.

3. Take the students outside for a bird observation walk. Tell them that being quiet is very important in order to see birds. Have them listen for birds as well as look for them. When a bird is seen, have the students note as many different features as possible. Bill shape, body shape, size, tail type and length, leg length, color, stripes, song, and behavior are important factors in determining what type of bird it is. Unless the species of bird is obvious, don't try to identify the bird, but rather try to determine what group of birds it is part of. If no birds are seen or heard, ask the students why the birds aren't around. A predator may be around,

Suggested Procedure (Con't):

and the birds could be hiding. Loud noises may have scared the birds off. If there isn't sufficient cover or food, birds may not be in the area. Early in the morning and late in the day are the best times to see birds. They usually keep cool during the heat of the day. Ask the students what birds do in bad weather? They seek protection. Cavities in trees, dense foliage or thickly clumped branches, shady places underneath roofs, and the insides of abandoned buildings are all good hide-outs when shelter is needed.

4. Have the students observe bird behavior on their own. Assign as homework a bird observation journal on one particular bird. Each student will pick a bird that can be seen around his or her home and watch it. In their journals, the students will write down identifying features about their birds. The following parts of the bird can be noted: size of bird (compared to a known object), bill type, color(s) of bird, distinguishing marks or features (stripes, eye rings, crests, colorful patches, etc.), leg length, body length, tail length, shape of wings, and shape of tail. Then have the students write down observations of the birds' behavior. Was it eating, preening (cleaning its feathers), taking a bath, flying, climbing trees, swimming, or walking? Ask them to draw the birds in their journals. When they bring their journals into class, have the students share their observations with their classmates. If a bird identification book is available, try to look up the bird and identify it. If not, have the student choose the category that they think the bird belongs to. Ask each student "What did you learn by watching the bird?"

5. An additional activity, which can be done in the classroom, is to learn about the habits of a migratory bird. Before scientists knew that birds migrated in the fall, people were mystified by the fact that birds would be around one day, and the next day they would be gone. One popular theory said that birds simply burrowed in the mud and hibernated through the winter like amphibians. This theory seems silly today, but in that time, no one had the capabilities needed to track birds and learn about their long flights. Have the class choose a bird that visits the Gulf Coast in the spring and summer, and migrates south in the fall for the winter. Study the habits of this bird. What food does it eat while it lives on the coast? Where does it build its nest? What type of habitat does the bird prefer? These questions can be answered through research in bird identification and bird behavior books. Good examples are: the prothonotary warbler, which winters from southeastern Mexico to Columbia and Venezuela; the summer tanager, which winters from Mexico to Brazil; the blue grosbeak, which winters from Mexico to Panama; the purple martin, which winters in South America; the ruby-throated hummingbird, which winters from Mexico to Central America; the yellow-billed cuckoo, which winters in Argentina; the swallow-tailed kite, which winters south of the United States; and the least tern (also called the little tern), which winters south of the United States, off the coast of Brazil. These birds come to the Gulf Coast to raise their young, and then they spend the winter in countries south of the United States where the food supply is greater and the weather milder. This is one of the reasons why conservation groups are trying to save land

Suggested Procedure (Con't):

not only in the United States, but also in the tropics, where many birds winter. Many migratory birds spend time on the barrier islands of Gulf Islands National Seashore resting and feeding before making that long flight across the Gulf to reach their southern destinations. These birds are referred to as neo-tropical migrants, because they migrate between North America and the neo-(or new world) tropics.

TYPES OF BIRDS

Swimming Birds
- loons
- grebes
- cormorants
- auks
- anhingas
- swans
- ducks
- mergansers
- coots
- gallinules

Aerial Divers
- shearwaters
- petrels
- pelicans
- frigates
- gannets
- boobies
- tropicbirds
- gulls
- terns
- skimmers

Wading Birds
- egrets
- herons
- bitterns
- storks
- cranes
- limpkin
- ibises
- spoonbills
- flamingos
- rails
- oystercatchers
- stilts
- avocets

Shorebirds
- plovers
- turnstones
- woodcock
- snipe
- dowitchers
- knots
- sandpipers
- phalaropes

Chicken-like Birds
- turkeys
- grouse
- pheasants
- ptarmigans
- quail

Birds of Prey
- kites
- hawks
- eagles
- ospreys
- vultures
- caracaras
- falcons
- owls

Non-passerines
- doves
- cuckoos
- anis
- goatsuckers
- hummingbirds
- kingfishers
- woodpeckers

Passerines
- flycatchers
- larks
- pipits
- swallows
- swifts
- crows
- ravens
- jays
- magpies
- titmice
- nuthatches
- creepers
- wrens
- kinglets
- gnatcatchers
- bulbuls
- thrashers

Passerines (con't)
- mockingbirds
- thrushes
- shrikes
- vireos
- warblers
- blackbirds
- starlings
- orioles
- tanagers
- finches
- longspurs
- juncos
- buntings
- grosbeaks
- towhees
- sparrows

IN THE WATER -- FISH!

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: Creature Features

Objectives:

To teach students about fish structure, behavior, and classification.

Materials:

* Copies of worksheet
* Pencils

Method:

Discuss with students the parts of a fish and how fish are classified. Students will fill in a "Fish Facts" worksheet.

Background:

The undersea world is ruled by fish, marine mammals, invertebrates, and plants. Fish are cold-blooded vertebrates that breathe oxygen by extracting it from the water with their gills. They are classified into three main groups, the bony fish, the cartilaginous fish, and the jawless fish. The jawless fishes are the lampreys and hagfish. The cartilaginous fishes are the sharks, rays, and skates. These fish have skeletons made up not of bones, but of cartilage. The bony fishes comprise all other fishes -- about ninety percent of the total fish population. Bony fish begin life as tiny eggs. Inside of these eggs, larvae develop, attached to a yolk. Eventually the larvae hatch. Once the yolks that have been feeding the larvae are gone, the young fish begin to feed on plankton. If they survive, the larvae develop into fry, and finally into adult fishes. Fish eggs, larvae, and fry are food sources for many creatures. The cartilaginous fishes, on the other hand, bear their young live (in the case of some sharks) or tucked neatly into egg cases. The egg cases are sometimes called "Mermaid's purses" and hold inside of them developing embryos. Eventually, the animals hatch from their protective homes and face the big ocean on their own. Fish do not care for their young. A variety of foods are eaten by fish, including plants, plankton, invertebrates, and other fish. What a fish eats has a lot to do with what its mouth looks like. Scavengers, such as catfish, have mouths that point downward, where their food is located. Predators have mouths facing forward or upward, and may also have teeth of varying shapes and sizes. Plant and plankton eaters may not have teeth at all. Most fish have swim bladders which inflate or deflate to keep the fish neutrally buoyant. This means that the fish neither sinks to the bottom nor rises to the surface, but simply remains at the desired level. When the fish changes its level, it adjusts its swim bladder accordingly. Sharks, skates, rays, and flatfishes are some of the fish that do not have swim bladders. Fish also have an interesting feature called a lateral line. The line runs along the middle of each side beginning behind the gills and ending where the tail starts. This line can detect disturbances in the water and serves the fish as

Background (Con't):

an extra sense. The lateral line helps fish to stay in schools, detect pressure changes, and avoid predators. Not all fish have lateral lines, some have isolated sensory pores that serve the same function. A few fish are able to produce an electrical charge. They possess special organs in their bodies which are used to scan through murky water (like radar) for hidden objects, or to shock a potential predator or prey!

Suggested Procedure:

1. Discuss with the students the parts of a fish. On the blackboard draw a picture of a fish and identify the following features: mouth, nostrils (directly above mouth), eyes, gills (below and behind the eyes and in front of pectoral fins), pectoral fins (fins that protrude out of each side of the fish near the head), pelvic fins (a pair of fins that are below the pectoral fins and point downward), anus (on the underside of the fish, around the middle), anal fin (runs along the underside of the fish from behind the anus and ends prior to the beginning of the tail), caudal fin (tail), dorsal fin (runs along the top of the body, it can be long or short, and some fish have more than one), and lateral line (runs above the pectoral fins from behind the gills until the beginning of the tail). Not all fish have all of these fins, they have different combinations of them. Discuss with the students how fish breathe. Tell the students that fish extract dissolved oxygen from water using their gills. Most fish cannot breathe oxygen from the air.

2. Tell the students a fish story. One of the most unusual fish tales is that of the American and European eels. These eels begin life off the Atlantic coast in the Sargasso Sea. They are born in the sargassum weed that floats in a huge jungle-like mass in the Atlantic, south of Bermuda. (Each eel mother may have deposited as many as ten million eggs there.) Once the eels hatch, they begin to grow. When the young eels are one to two inches long, they are flat, transparent creatures and are referred to as leptocephali (lep-teh-SEF-eh-lie), meaning "thin heads." The little leptocephali begin to swim northward. Believe it or not, these eels know whether or not they are European or American and head in the appropriate direction. Once the baby eels make it to a mainland they are fully developed, but only about three inches in length. Now they are called elvers, or glass eels. Here the males and females separate. The males remain at the mouths of rivers or in the ocean near shore, while the females begin a most incredible trek to the homeland of their mothers -- an inland body of water such as a pond or a lake. To reach their destinations, the female eels may travel hundreds of miles, up rivers, dams, waterfalls, and through pipelines. Female eels have been found in isolated ponds with no streams leading in or out. This has led scientists to believe that the eels wriggle overland through wet areas to arrive at their ancestral homes. The females remain in fresh water for seven to fifteen years. During this time, they may grow to a length of five feet. Eventually, the female eels swim downstream to reunite with the males. After they meet, the males and females swim

Suggested Procedure (Con't):

thousands of miles together, back to the Sargasso Sea to breed. Here their young will begin the amazing cycle all over again.

3. Have the students fill out the true or false questions on the "Fish Facts" worksheet. After the worksheets are completed, discuss the answers with the class.

ANSWERS TO FISH FACTS WORKSHEET

1. **T** - Eels and seahorses are fish.
2. **F** - Sturgeons don't have teeth. They suck their prey into their mouths.
3. **T** - Skates lay their eggs in egg cases commonly called "Mermaid's purses."
4. **F** - Hogchokers, like other flatfish, are delicious.
5. **T** - The eyes on flat fishes are found on the right or left sides of their heads.
6. **F** - "Redfish" is another name for red drum.
7. **T** - The pectoral fins of the sargassum fish are used like hands to move around, and to push food into its mouth.
8. **F** - Fish are vertebrates. They have backbones.
9. **T** - We might not call it singing, but toadfish do hum loudly.
10. **F** - Manta rays eat mostly shrimp and plankton, and are harmless. They are often seen jumping out of the water.
11. **T** - Sharks have cartilage instead of bones.
12. **F** - Whale sharks eat plankton, not other sharks.

FISH FACTS

NAME:_____ **DATE:** _____

Circle either "T" for true or "F" for false.

1. Eels and seahorses are fish. **T or F**

2. Sturgeons have teeth. **T or F**

3. Skates lay their eggs in Mermaid's purses. **T or F**

4. Hogchokers (flatfish) taste horrible. **T or F**

5. Flounder can actually be right-eyed or left-eyed. **T or F**

6. Red drum and redfish are totally different fish. **T or F**

FISH FACTS

NAME: _____ **PAGE 2**

Circle either "T" for true or "F" for false.

7. Sargassum fish can use their pectoral fins like hands. **T or F**

8. Fish are invertebrates. **T or F**

9. Gulf toadfish can sing. **T or F**

10. Manta rays will eat anything that moves. **T or F**

11. Sharks don't have bones. **T or F**

12. Whale sharks eat whales. **T or F**

ON THE GROUND -- SNAKES!

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: Creature Features

Objectives:

To teach students snake structure, behavior, and their role in the environment.

Materials:

* Copies of worksheet
* Pencils
* Snake identification chart (if possible)

Method:

Discuss with the students the basic structure of a snake. Explain their role as predators and their importance in the environment. Discuss poisonous and non-poisonous snakes and their behavior. The students will fill out a worksheet, "Snake Misssss-conceptions."

Background:

Snakes. The word alone can put fear into the hearts and minds of some people. Why do snakes evoke such bad feelings? It began when they were depicted as evil in the Garden of Eden, and this unfortunate -- and undeserved -- reputation has continued since. Some people seem to feel that snakes are out to get them. In reality, snakes try to remain unnoticed by other animals as they go through their daily routines of searching for food, shelter, and mates. Sometimes, though, they are seen, and here the trouble begins. Snakes are nearsighted, which means that they cannot see things clearly unless the objects are right under their noses. Once a snake has been discovered, its first instinct is to flee. Many animals eat snakes; but snakes do not eat people, so they would not expend any energy trying to chase a person. The snake will try to head away from the person who frightened it, but if it can't, it may crawl past the person in order to escape. This is when people think they are being chased by a snake. Would you charge after a creature hundreds of times your size? Sometimes snakes are cornered, or are found already coiled. This is when a snake may hold its ground. If it tried to run, it might be vulnerable to attack. But coiled, it could strike if necessary. Now it seems as if the snake is bold and ferocious, but it is just being protective -- of itself. A snake will not strike at a person unless it is provoked in some way. Snakes do not bite for the fun of it.

Snakes find food by "tasting" the air with their tongues. The snake's tongue darts out, and then is placed into a two-parted groove in the roof of the snake's mouth. There a specialized organ determines whether or not the scent of dinner is in the air. Snakes have three basic methods of subduing prey: grabbing, constricting, and injecting venom. A grabber simply snatches up small

Background (Con't):

animals with its mouth. A constrictor coils around its prey, continually tightening its grasp every time the animal takes a breath. In order not to be bitten by a potential meal the snake will try to grab the animal by the mouth. Once the animal has breathed its last, the snake will swallow it whole, usually head first. The snake accomplishes this by opening up its expandable jaws and moving the prey down its mouth and into its stomach for digestion. Poisonous snakes, by contrast, use venom to subdue their meals. A poisonous snake does not have an unlimited supply of venom but must manufacture what it uses. If the snake strikes at something that it cannot eat, it may be a while before it can make enough venom to hunt again. Perhaps this is why poisonous snakes are able to give "blank" bites, injecting no venom into the "bitee." If a snake is being harassed, its only defense, after trying to escape, is to bite. It cannot yell, throw things, kick, or punch its harasser. What else is a snake to do?

Understanding is important for the survival and enjoyment of snakes. Snakes are vertebrates (they may have over 200 individual backbones). They are cold-blooded, and belong to the class of animals called the reptiles. Snakes are truly beautiful creatures, streamlined for action and decorated with finely designed overlapping scales. Red, yellow, green, black, and brown are some of the colors they display. Snakes don't have eyelids, so it seems as if they are always staring. Most snakes cannot vocalize. A few can hiss, but they are the exception. Rattlesnakes can warn people of their presence by rattling their tail. Other snakes use this technique too, only they vibrate their tails in dried leaves to produce a "rattle." Snakes do not have external ears. They sense sound by vibration. When walking in an area that might have snakes, pounding the ground firmly with each step will help to alert snakes and give them a chance to vacate.

All baby snakes begin life inside eggs. When certain snakes give birth (pit vipers and garter snakes, for example), the egg shell breaks, and the young are live-born. Other snakes lay eggs on the ground, from which the babies hatch. Snakes do not care for their young like mammals do.

All in all, snakes are a very important part of the environment. They eat rodents, insects, birds, eggs, lizards, amphibians, and even other snakes. They keep the food web in balance and add to the interesting diversity of life.

Suggested Procedure:

1. Ask the class, "Is anyone afraid of snakes?" If the students respond positively, ask them why. In the majority of cases, the fear of snakes is bred by other people's fear of snakes, not their own. They hear horrible stories about snakes, read about snakes being evil, and learn to fear snakes even before they have ever met one. Some people have had snakes shoved in their

Suggested Procedure (Con't):

faces. (This is no fun for the person or the snake.) Snakes just haven't had a fair chance to show people that they are interesting creatures, just like other animals. Now ask the class if anyone likes snakes. Hopefully there will be a snake enthusiast who can share some insight with the class. If anyone in the class keeps snakes, perhaps one be brought to school to show to the class. Touching snakes is a fun experience because they are smooth, not slimy. Some snakes have scales as smooth as glass: they are the ground dwelling snakes. Other snakes have slightly rough scales that aid them when climbing trees. Do snakes jump out of trees? No, but they may fall by accident, which can cause them to get hurt. With a little knowledge and exposure it is amazing to see how the fear of snakes can disappear.

2. Discuss snake safety. Ask the students if they know how to tell a poisonous snake from a non-poisonous snake. The shape of the head is not a reliable method. Most poisonous snakes have a triangular head. But some don't. The poisonous coral snake is a slender-headed beauty. It is ringed with bands of yellow, red, and black. But so is the scarlet king snake, a non-poisonous snake. The difference between the two is that the "warning" colors of yellow and red touch each other on the coral snake, but not on the scarlet king. Some non-poisonous snakes flatten their heads to make themselves look like their poisonous relations, perhaps to scare off potential predators. One snake has the most famous act of them all -- the hognose snake. When cornered this snake may flare out the sides of its neck and rock from side to side, resembling a highly poisonous cobra. If this doesn't succeed in scaring off a potential enemy, the snake may give an encore performance by rolling over on its back and playing dead! But its act doesn't always end here. The snake may also stick its tongue out, and if it feels the need to be especially convincing, it may bleed from its mouth lining. This is quite a routine! The snake also believes that in order to be "dead" it must lie on its back. If it is flipped over onto its belly in the middle of a performance, the snake will quickly roll over again! The most reliable way to know if a snake is poisonous or not is to be able to identify the different snakes in the area. In all cases, the best rule to follow is to move away from the snake, and leave it alone. This way you won't disturb the snake, and it won't bite you.

3. Have the students fill in the "Snake Misssss-conceptions" worksheet. After the students have finished, discuss the answers with the class. If a snake identification chart is available, review the different snakes with the students.

SNAKE MISSSSS-CONCEPTIONS

ANSWERS

1. **B** - Snakes feel cool to the touch because they are cold-blooded, and their temperature is not any higher than that of their environment. Snakes are not slimy.

2. **B** - Non-poisonous snakes sometimes rattle their tails to try and scare other animals away. This sounds very convincing when it is done in dried leaves.

3. **B** - A snake can "smell" the air with its tongue. It uses an organ on the roof of its mouth to decode these smells.

4. **C** - Snakes are afraid of larger animals because they can be trampled or eaten by them.

5. **B** - Snakes do not have good long-distance vision. (They are nearsighted.) Snakes cannot hypnotize animals. They seem to stare only because they have no eyelids.

6. **A** - Many more people die each year from bee stings than from snake bites. Most of the people who are bitten by a snake were either trying to kill it, or catch it.

7. **C** - Snakes have backbones, and therefore are vertebrates.

8. **B** - There is a common group of legless lizards called the glass lizards. They resemble snakes, but like other lizards they have eyelids and external ears.

9. **C** - King snakes eat other snakes, even poisonous ones. King snakes are immune to the venom of poisonous snakes, but poisonous snakes are not immune to their own venom!

10. **B** - If a poisonous snake is encountered, carefully walk away from it. Do not poke, hurt, or kill the snake. The majority of snake bites occur when people harass snakes. Snakes are an important part of the food chain -- so live and let live!

SNAKE MISSSSS-CONCEPTIONS

NAME: _____ **DATE:** _____

Circle one answer for each question

1. Snakes feel _____.

a) slimy
b) cool
c) squishy

2. If a snake rattles its tail, it must be a rattlesnake.

a) true
b) false

3. Snakes can _____ with their tongues.

a) sting
b) smell
c) shoot spitballs

4. Most snakes are _____.

a) poisonous
b) break dancers
c) afraid of people

5. Snakes _____ animals in the distance.

a) will hypnotize
b) can't see
c) will chase after

NAME: _____ **PAGE 2**

Circle one answer for each question

6. Bees harm more people than snakes do.

a) true
b) false

7. Snakes are _____.

a) warm-blooded
b) amphibians
c) vertebrates

8. All legless lizards are snakes.

a) true
b) false

9. Some snakes eat _____.

a) grass
b) pizza
c) other snakes

10. What is the best thing to do if you see a poisonous snake?

a) poke it
b) carefully walk away
c) kill it

IN THE SAND -- CRABS!

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: Creature Features

Objectives:

To teach students about crab anatomy and behavior.

Materials:

* Copies of Crossword Puzzle, list of words, and clues
* Pencils

Method:

Discuss with the students the parts of a crab. Explain how crabs eat, and discuss their adaptations. Afterward, the students will fill out a "Crab Crossword."

Background:

Crabs belong to the group of arthropods called the crustaceans. All members of the group arthropoda have exoskeletons. In other words, they wear their skeletons on the outsides of their bodies. These hard skeletons are made of chitin, a substance secreted by cells in the animals' body. In order for an arthropod to grow, it must shed its old shell. It begins to produce a new, soft exoskeleton underneath the old one. Then the old exoskeleton cracks, and the animal climbs out. During this process the animal absorbs air and water, and growth takes place. Then the animal's shell hardens. It will remain the same size until the animal sheds again.

There are many types of crabs in the Gulf of Mexico and the surrounding waters. True crabs have five pairs of legs, one pair with claws, the others modified for walking or swimming. Crabs usually move sideways. Most crabs have gills which are used to extract oxygen from the water, or in some cases, from the air. Crabs have an unusual type of mouth. They have two appendages (called mandibles) that fit like doors over their mouths. Crabs use their claws to bring food up to these mouthparts for consumption. Baby crabs begin life in eggs carried by their mothers. When they hatch the young crabs start out life as zoea larvae. Then they pass through successive molts, become megalops larvae, and finally develop into adult crabs. During each of these molts a metamorphosis takes place that changes the shape of the larvae into a different form.

Blue crabs are probably the most well known crabs along the Gulf Coast. People eat large quantities of blue crabs, both in their hard-shelled and soft-shelled stages. A crab is called soft-shelled after it has shed and its exoskeleton has not yet hardened. Stone crabs have extremely delicious claws. When this crab is caught, only one claw is broken off, and the crab is thrown back into the water. A new claw regenerates after about three molts. Fiddler crabs are small crabs that move around in

Background (Con't):

the mud along the edges of salt marshes. The male fiddler crabs have one claw that is extraordinarily large, and they use it to display for the females. Fiddler crabs live in burrows below the high tide line. When the tide recedes, the crabs come out onto the mud to harvest meals of detritus (decaying organic matter). Ghost crabs are nocturnal crabs that live on beaches in burrows dug into the soft sand. They come out at night to hunt the water's edge, and also to wet their gills in the surf. As long as the ghost crab keeps its gills sufficiently wet, it can actually extract oxygen from the air. Wharf crabs are small, brown crabs that usually are found along structures jutting into the water. Another crab that is common along the Gulf Coast is the hermit crab. This crab is not considered a "true crab" because its abdomen is shaped differently than other crabs. The hermit crab has a soft abdomen, and for protection, it lives in the discarded shells of snails. When the hermit crab grows, it must find a larger home to live in. Another "untrue" crab is the Horseshoe crab. It is placed by scientists in a different group altogether. (See "Creature Features" for more information on this interesting beast.) Most crabs are scavengers, living on diets of decaying plant and animal matter. Some crabs are predacious, dining on smaller crustaceans and fish. All crabs are opportunists and will eat almost anything they are lucky enough to sink their claws into.

Suggested Procedure:

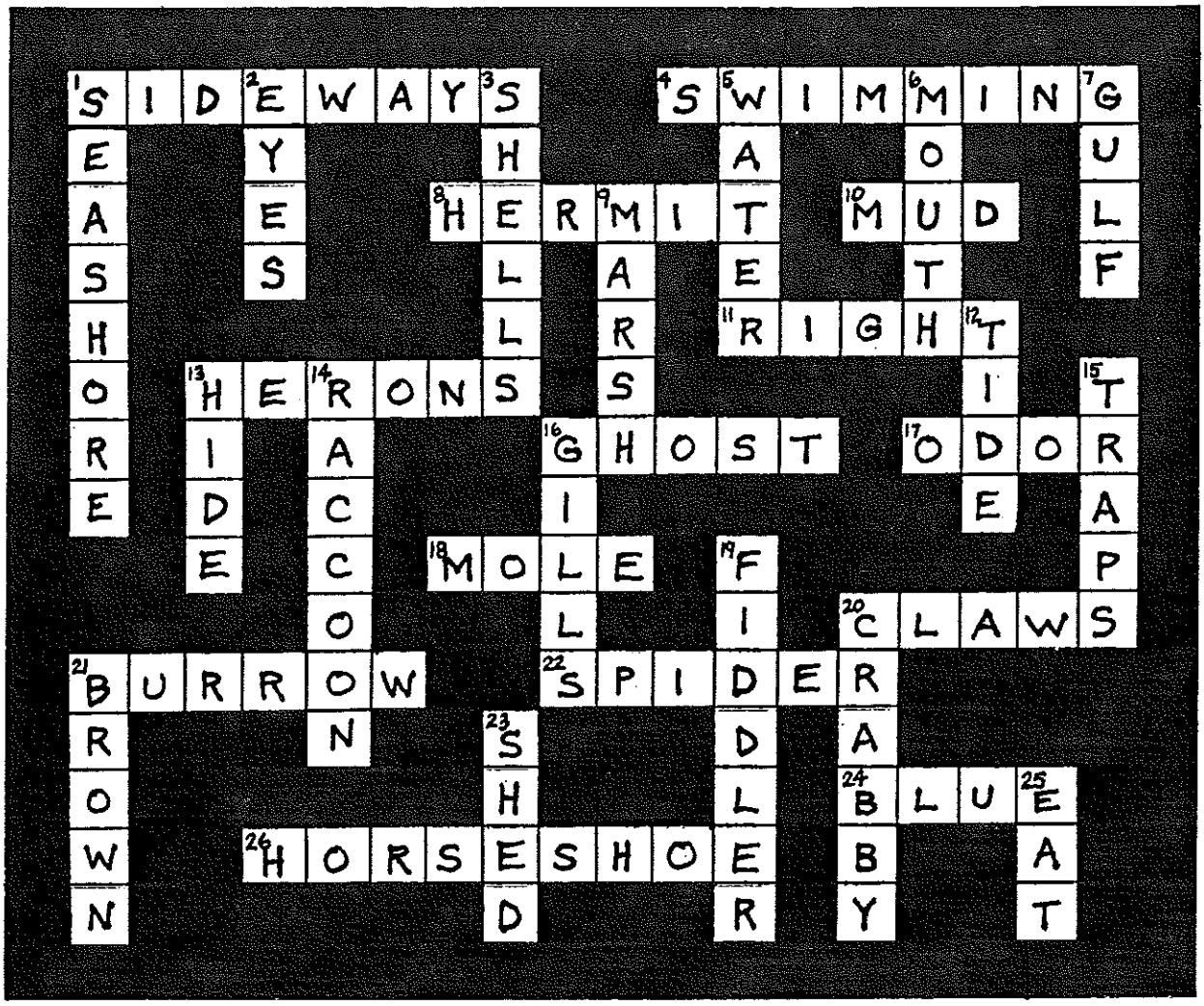
1. Discuss crab anatomy with the students. Draw a picture of a crab on the blackboard. Identify the following parts: body (rounded, elongated, or square), small antennae (extending from face area), mouthparts (mandibles), first pair of legs with claws, four more pair of legs (the last pair can be swimming paddles if drawing a blue crab), and eyes (can be at the end of stalks).

2. Discuss crab adaptations with the class. Explain how crabs use their claws to bring food to their mouths, and also for defense. Discuss crab exoskeletons, and how crabs shed. Talk about different crab habitats, and how crabs that live on land need to return to water periodically to moisten their gills. Discuss with the students how crabs use gills to breathe. Ask the students to share any sightings or information that they know about crabs.

3. Have students fill out the "Crab Crossword." A list of the words used in the crossword puzzle is supplied. Hand this out to the students so they may refer to it if they are unfamiliar with a word or can't guess it. The list is organized by word length so the students can search for the words that would fit the number of blanks in the clue. After the puzzles are completed, discuss the answers with the class.

CRAB CROSSWORD

ANSWERS



CRAB CROSSWORD

CROSSWORD WORDS

3 Letter Words

EAT
MUD

4 Letter Words

BLUE
EYES
GULF
HIDE
MOLE
ODOR
SHED
TIDE

5 Letter Words

BROWN
CLAWS
GHOST
GILLS
MARSH
MOUTH
RIGHT
TRAPS
WATER

6 Letter Words

BURROW
CRABBY
HERMIT
HERONS
SHELLS
SPIDER

7 Letter Words

FIDDLER
RACCOON

8 Letter Words

SEASHORE
SIDEWAYS
SWIMMING

9 Letter Words

HORSESHOE

CRAB CROSSWORD

ACROSS CLUES

1. Most crabs don't move forward or backward, they move _____.

4. Crabs are often seen _____ in the water.

8. A _____ crab hides in its home when you pick it up.

10. Some crabs live in the _____ that gets exposed during low tide in the salt marsh.

11. Fiddler crabs may be left-clawed or _____-clawed.

13. Tall wading birds called great blue _____ often eat crabs.

16. _____ crabs were probably named this because they come out at night, are white, and can hardly be seen.

17. The marsh sometimes has an _____ that some people thinks smells bad.

18. The _____ crab was probably named after a mammal who lives underground and digs tunnels.

20. Crabs use their _____ not only to gather food, but also to defend themselves.

21. A crab may make its home underground in a _____ that it digs in the sand.

22. The _____ crab has very long legs, and if Miss Muffet saw one, she would probably run away.

24. _____ crabs were named because their legs are this color.

26. This creature is actually not a crab, even though it is called a _____ crab. (Hint: this is also something that a horse would wear on its foot).

CRAB CROSSWORD

DOWN CLUES

1. Gulf Islands National _____ takes care of some very special places.

2. Some crabs have their _____ on the end of stalks so they can see better.

3. Old snail _____ are used by some crabs for their homes.

5. Some crabs live in _____ and some crabs live on land.

6. A crab uses its claws to bring food up to its _____.

7. In the _____ of Mexico there are many different types of crabs.

9. This is a place where slow moving water surrounds plants. It is also part of the name of this fun treat: _____mallows.

12. Some crabs have to wait for the _____ to go out before they can eat.

13. Crabs need to _____ from predators.

14. The _____ comes out at night, wears a mask, and likes to eat crabs.

15. One way to catch crabs is to use crab _____.

16. People use lungs to breathe, and crabs use _____.

19. Male _____ crabs have one extremely large claw, which makes it look like they are playing a violin.

20. If you were tired and cranky, someone might say to you "Stop being so _____."

21. Wharf crabs are _____ in color and often hang around boat docks. (Rhymes with town).

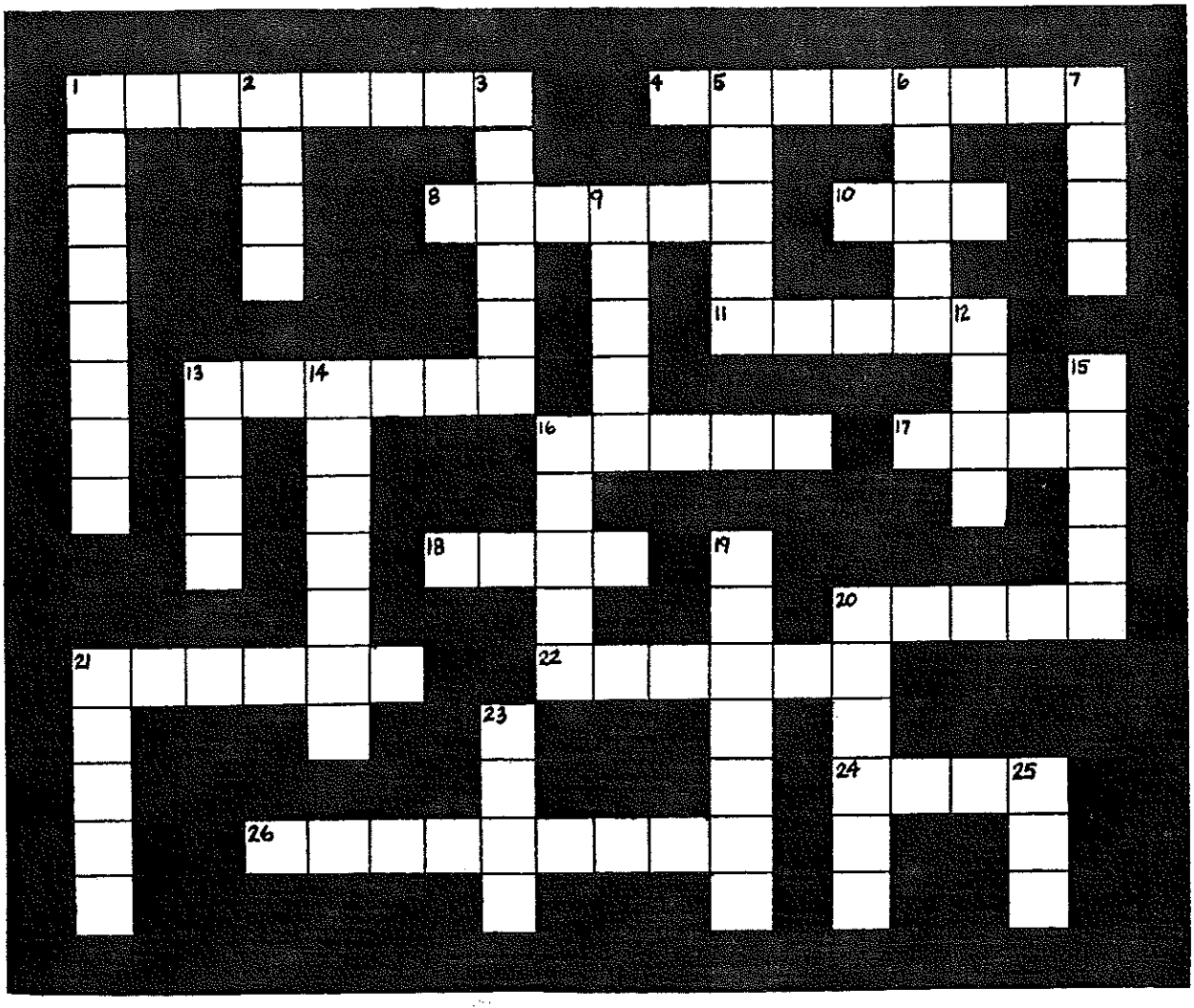
23. In order for a crab to grow, it must _____ its shell.

25. People like to _____ steamed crab claws.

IN THE SAND -- CRABS!

NAME: _____ **DATE:** _____

CRAB CROSSWORD



CAMOUFLAGE CRITTERS

Subject: Science
Duration: 1 hour (each activity)
Location: Classroom and Outdoors
Related Activities: Creature Features

Objectives:

To teach students about camouflage and how it can be useful in protecting creatures from predators.

Materials:

* Copies of worksheet
* Colored pencils or crayons
* Sticks and bark
* Leaves and grass
* Feathers and rocks
* Clay

Method:

Discuss with the students the definition of camouflage. Explain how coloration and behavior can combine to make a prey animal almost invisible to predators. Students will color creatures to blend in with their surroundings and play a game, "Camouflage Critters."

Background:

Camouflage is both an external appearance and a behavior pattern that helps an animal become indistinguishable from its surroundings. An animal's coloration, or a particular body part, allows it to blend in with its environment. Behavior assists in the animal's ploy. It may freeze, twist a part of its body in a particular way, or flatten out to avoid detection. Finding an animal that is trying to be "invisible" is quite an accomplishment. Many animals use camouflage as a defensive action against predators, and some predators use it to remain unseen by their prey. A common lizard, the anole (sometimes incorrectly called a chameleon) is a master at blending in with its surroundings. It changes its color to match the environment it is in -- brown or green. Anoles accomplish this with migrating pigment cells. A bittern (a bird similar to a heron) is not only colored like its marsh habitat; it also sticks its head and its long pointed bill straight up in the air when disturbed, making it appear like a blade of grass. This trick must work very well, as bitterns are one of the hardest type of birds to see. Ghost crabs are so called because they blend in so well with their white, sandy surroundings that when they are seen, they look like little ghosts running to and fro in the night. They are perfectly colored to match the sand in which they live. The mullet, like many other fish, uses the bi-color trick. Mullet are darkly colored on top, so when seen from above, they blend into the darkness of the water, and when seen from below, their light undersides are indistinguishable from the sky.

CAMOUFLAGE CRITTERS

Suggested Procedure:

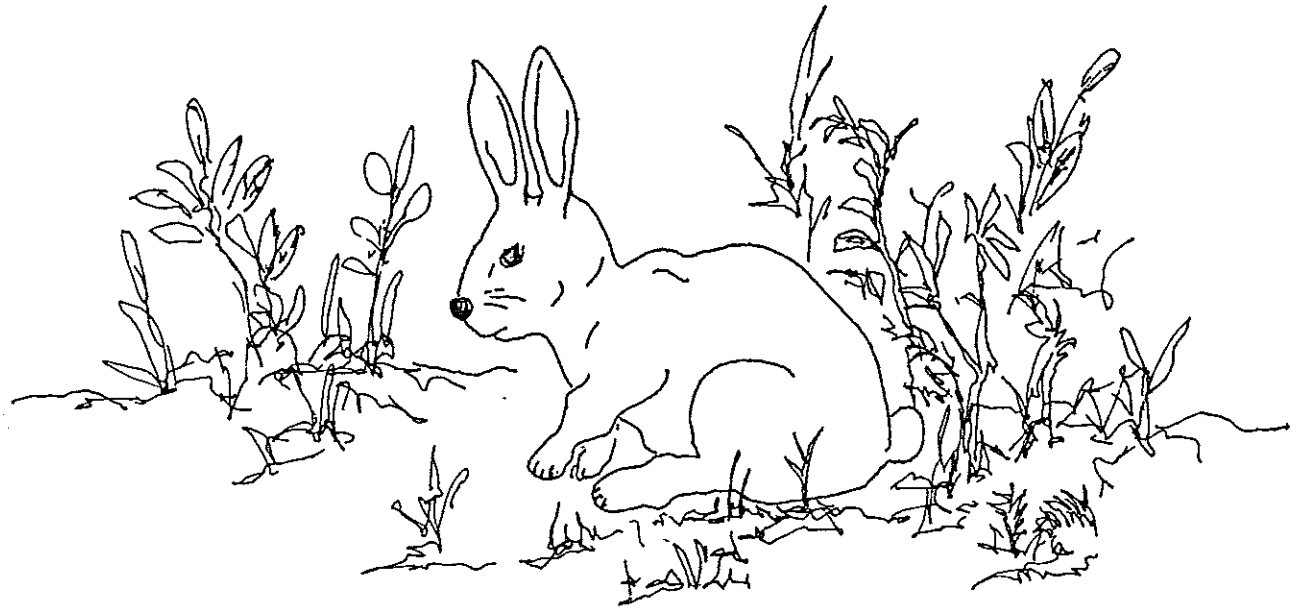
1. Discuss with the students what camouflage means. Ask them to describe a good example of camouflage. Explain that camouflage is not just coloration, but behavior also. If a cryptically colored (camouflaged) animal moves around, it will probably be detected. Usually animals freeze when they are trying to remain hidden. Some animals even have parts of their bodies designed to help camouflage them. The great horned owl is an excellent example. A researcher wanted to find out if the "horns" on the owl were used for hearing and in order to study this, clipped the horns off a few great horned owls. The results of the study were that the horns did not improve hearing, but that they were most likely used for camouflage. The irregular horns on the top of great horned owl heads help to make the birds look like broken off branches. This is very useful during the daytime when the owls roost in trees. With the additional coloration of brown earth tones, the owls just seem like part of the woodwork. Some animals can actually change color at will. The green anole may be green or brown depending upon its current location. Some fish will have spots or stripes one minute, and none the next. Certain creatures even have "eye" spots on their bodies so they appear to be looking in one direction, when in reality, they are facing in another. Prey animals are not the only ones trying to remain undetected. The more a predator blends into its environment, the better its chances are of catching a meal. The alligator is a great imitator of part of its environment, the floating log. Its coloration, rough skin, and ability to float motionlessly has probably been the undoing of many unsuspecting animals.

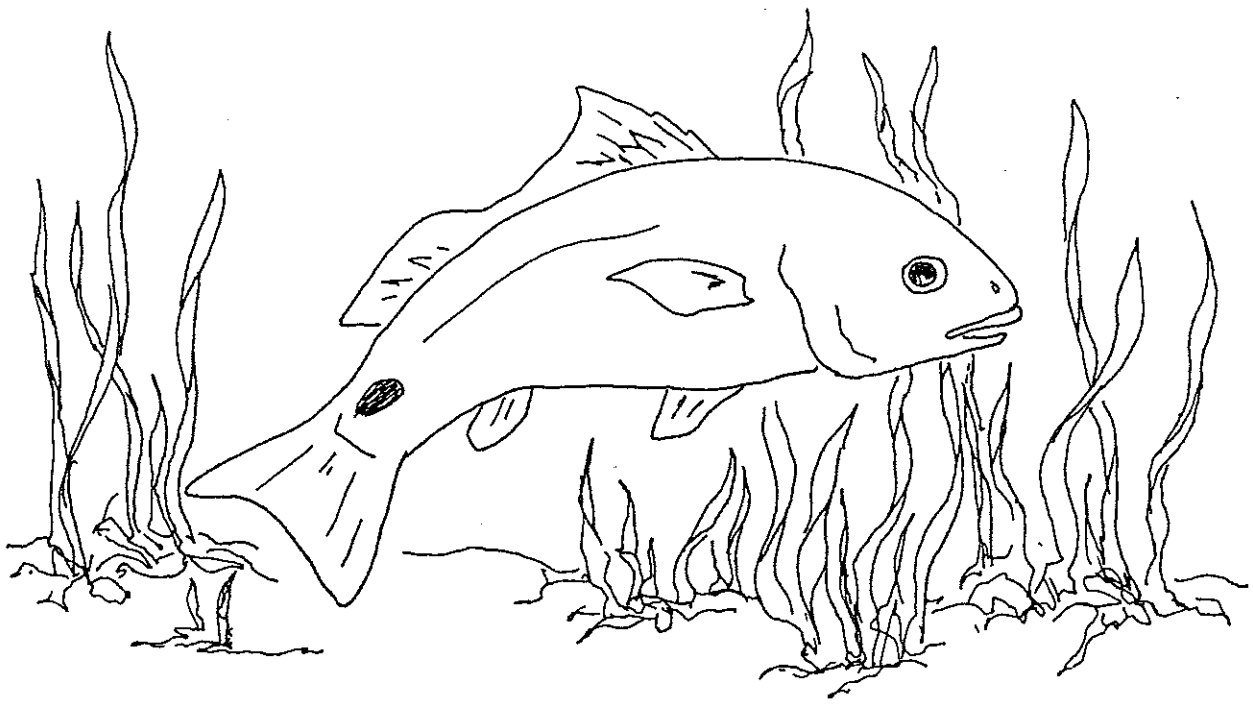
2. Have the students color in the "Can You Find Me?" worksheet. Ask them to color the creatures so they appear to be part of their habitats. After they have finished coloring, ask the students to name one thing an animal might do to help remain unseen. Some responses may be: keep still, move a body part in a particular way to help make the animal look like something in its habitat, flatten out, or change color.

3. As an additional activity, students can build their own "Camouflage Critters." Using natural elements found outside, such as leaves, grass, sticks, stones, and feathers, have the students create critters that will blend in around the school yard. Clay can be used for holding the natural objects together. Once the students have created their critters, bring the students outside and give them a few minutes to hide their critters (not bury them) where they will be visible from at least one side. Once the class has hidden all the creatures, let the students try to find them. Then the owners can collect and identify their creatures. Were they all found?

CAMOUFLAGE CRITTERS

Color in the creatures below to match their environments





CAMOUFLAGE CRITTERS

Color in the creatures below to match their environments

MIGRATING MONARCHS

Subject: Science, Geography
Duration: 1 hour
Location: Classroom
Related Activities: Here Today, Gone Tomorrow?

Objectives:

To teach students about the life cycle of the monarch butterfly.

Materials:

* Copies of migration worksheet
* Pencils

Method:

Discuss the details of monarch development from egg to caterpillar to pupa to butterfly. Explain the unique migration pattern of this insect. Students will map out some of the migration routes of the monarch.

Background:

The monarch butterfly, often called the wanderer, has an amazing feature that among insects is almost unheard of -- the urge to migrate. Certain monarch butterflies travel hundreds (some even thousands) of miles to and from Central American wintering grounds. Monarch butterflies cannot withstand freezing temperatures in any stage of their development, so in order for them to survive in North America, they must migrate to warmer climates for the winter. This amazing flight of butterflies was only recently discovered and documented.

In the fall, monarch butterflies east of the Rocky Mountains migrate southward to Mexico. In very specific, select locations, they spend the winter in large groups, clinging side by side on trees. In one tree there may be 10,000 butterflies! These groups are called clusters. As the end of winter approaches, the monarchs begin to mate, and then they fly northward, depositing eggs along the way. These eggs develop into adults in about thirty days, and these second generation monarchs also journey northward. The butterflies that spent the winter in Mexico soon die, but their offspring remain to carry on the monarch life cycle. At about four weeks of age, the young butterflies begin to lay their own eggs. About five or six generations of monarchs are born throughout the warm months. These recent generations of butterflies (the ones born in the spring and early summer) live for only about six weeks. Then a very interesting change takes place. The final generation of butterflies born at the end of the summer is physically different from the previous short-lived generations. These monarchs are able to eat more nectar and hold more body fat. They are the butterflies that will migrate south, over-winter in Mexico, and bear the young that will perpetuate their species. These butterflies may live six months or more. How this "super generation" is created scientists do not yet

Background:

understand, but without them, the monarch butterflies would not survive. The super butterflies that reach Mexico are probably the great-great-great-grandchildren of last winter's migrating butterflies!

Due to the fact that the over-wintering butterflies travel to only a few specific locations in Mexico, they are very vulnerable to destruction of their winter habitat. When trees are cut in or around a monarch cluster, the butterflies may move to another area. But what if they couldn't find another suitable area? The loss of wintering monarchs would greatly endanger the survival of the species. Therefore, the unusual migratory pattern of the monarch has been designated as an endangered phenomenon in order to protect this truly beautiful and amazing member of the animal kingdom.

Suggested Procedure:

1. Discuss with the students the development of a monarch butterfly from egg to adult. Explain to the students that monarch butterflies lay their eggs on the undersides of milkweed leaves, and only on milkweeds. These plants are common wildflowers, abundant in North America. Each egg is tiny, about the size of a pinhead. In four days the larva hatches. It is white with a dark head, about one sixteenth of an inch long. The larva eats voraciously and quickly grows larger. It frequently sheds its skin, or exoskeleton, and slowly begins to look like a caterpillar. Eventually it will have yellow, black, and white stripes, and two pairs of black "horns," one pair at each end of its body. In fifteen days, the caterpillar has increased its weight by more than 2,700 times. If a human baby were to grow at the same rate, at the age of two weeks, it would weigh more than a 100-ton blue whale! At this stage in development the caterpillar finds a sturdy branch to hang onto, and attaches itself there firmly, using a specialized hook on its rear end. Here, over a period of hours, the caterpillar surrounds itself with a jewel-like green casing, called a chrysalis. It is now in its pupal stage. Many changes will take place inside the caterpillar's new home. It is on its way to becoming an adult butterfly, the familiar orange and black striped creature recognized as the monarch. This transformation is called a metamorphosis. It will take approximately two weeks for the completion of the process. Eventually the green chrysalis will become translucent, and the butterfly can be seen curled up inside. Within a short time, the adult butterfly breaks free and begins to stretch its wings. Fluids from inside the abdomen flow into the wings, expanding them to their full size. Once the wings harden, the butterfly is ready to fly. As an adult, the butterfly feeds on the nectar of flowers using a strangely shaped mouthpart called a proboscis. It looks like a New Year's Eve party favor that uncurls when the butterfly reaches down into flowers to suck out their nectar.

2. Explain to the students that monarch butterflies migrate in order to survive the winter months. They must go to a location where it does not freeze, or they will die. Monarchs that live east of the Rocky Mountains migrate to Mexico. Tell the students that the monarch butterflies they see in the spring are not the same butterflies that migrate southward in the fall. Discuss the amazing life cycle of the monarchs.

Suggested Procedure (Con't):

3. Have the students follow the directions on the "Monarch Migration Activities" worksheet. The students will mark given points along the migratory routes of the monarch butterflies on the "Monarch Migration Map." With the class, discuss the maps and the different generations of butterflies that are created along the way. Explain that monarch butterflies are very dependent upon milkweed and Mexican wintering grounds for survival. Without milkweed, monarchs could not raise their young. Without the protection of wintering grounds, the species would not survive. Due to this amazing migration pattern, the behavior of the monarch has been designated as an endangered phenomenon. People are working to protect habitat for the monarchs so that we can look forward to seeing these beautiful wanderers for many summers to come.

MONARCH MIGRATION ACTIVITIES

1. Male and female monarch butterflies leave Mexico after the winter ends and head north.

IDENTIFY MEXICO ON THE MAP

2. As the butterflies pass by the Gulf Coast, females will lay some of their eggs on milkweed plants.

IDENTIFY THE GULF COAST ON THE MAP

3. Some of the butterflies continue to fly northward, the females laying eggs along the way. They will spread out all over the states that are east of the Rocky Mountains.

IDENTIFY THE ROCKY MOUNTAINS ON THE MAP

4. Many butterflies will fly as far north as Canada.

IDENTIFY CANADA ON THE MAP

5. The eggs that were laid on the Gulf Coast hatch, the young turn from caterpillars into butterflies, and fly they northward perhaps to New England.

IDENTIFY NEW ENGLAND ON THE MAP

6. During the summer, the butterflies that wintered in Mexico die, but their young will lay eggs. These eggs hatch, turn from caterpillars into butterflies, and also lay eggs. This happens all summer long. At the end of the summer, a type of "super" butterfly is born. These butterflies will be the ones to return to Mexico for the winter. They will begin their journey

MONARCH MIGRATION ACTIVITIES (CON'T)

6. (Continued) southward and may pass through Gulf Islands National Seashore.

IDENTIFY GULF ISLANDS NATIONAL SEASHORE ON THE MAP

7. Some of the "super" butterflies fly toward the Gulf Coast, where they may stop to rest before flying to Mexico.

IDENTIFY THE GULF OF MEXICO ON THE MAP

DRAW A LINE ON THE MAP FROM CANADA TO THE GULF COAST

DRAW A LINE ON THE MAP FROM NEW ENGLAND TO THE GULF COAST

8. From the Florida and Mississippi Gulf Coast the butterflies fly along the Texas Gulf Coast to reach Mexico where they spend the winter.

DRAW A PATH ON THE MAP AROUND THE GULF COAST TO MEXICO

9. When the winter ends, the butterflies will leave Mexico and fly northward again, possibly even passing through the Gulf Coast along the way.

RETRACE THE PATH FROM MEXICO TO THE GULF COAST

RETRACE THE LINE FROM THE GULF COAST TO NEW ENGLAND

RETRACE THE LINE FROM THE GULF COAST TO CANADA

10. And the butterfly life cycle continues . . . .

MONARCH MIGRATION MAP

INTERESTING AND IRRITATING INSECTS

Subject: Science
Duration: 1 hour (each activity)
Location: Classroom and Outdoors
Related Activities: Creature Features

Objectives:

To teach students about insects, their structure, behavior, and usefulness.

Materials:

* Hand lenses
* Jars
* Wooden beads
* Spools
* Clothespins
* Pipe cleaners
* Sequins or beads
* Glue

Method:

Discuss with the students the parts of an insect. Explain the role insects play in the environment. Have students examine insects using hand lenses. Students will also build their own insects and write stories about them.

Background:

Insects, whether we like it or not, make up over half of the known living things on this planet. They are, at times, considered great pests. But their ecological importance is vast. Not only do they represent a huge proportion of the food source for other animals, but their pollination services are invaluable. Many vegetables, flowers, trees, and other plants are pollinated by insects. Birds consume gigantic numbers of insects, as do fish, reptiles, amphibians, and certain mammals. Insects also create products that people use: silk, honey, beeswax, and shellac. What exactly is an insect? It is a cold-blooded invertebrate of the phylum arthropoda, class insecta. From the time that insects begin life as eggs, they go through many changes, some gradual, others radical. Each change is referred to as a metamorphosis. Once the insect becomes an adult, it has three major body parts: the head, the thorax (the middle body part), and the abdomen. Three sets of legs attach to the thorax. Spiders, which have only two body parts and four pairs of legs, are not insects. Many adult insects have one or two pairs of wings, which are also attached to the thorax. Most have antennae which are attached to the head. In immature stages, insects come in a variety of shapes and sizes and are much harder to identify than adults. There are eight common groups of insects to which most species belong: 1) the bees, wasps, and ants, 2) the flies, mosquitos, and gnats, 3) the moths and butterflies, 4) the beetles, 5) the crickets, locusts, and grasshoppers, 6) the dragonflies and damselflies, 7) the aphids, cicadas, and leafhoppers, and 8) the (true) bugs, backswimmers, and water striders.

INTERESTING AND IRRITATING INSECTS

Suggested Procedure:

1. Discuss insect structure with the students. Draw and identify the parts of an insect on the blackboard. Include the three body parts: the head, the thorax (in the middle), and the abdomen. Insects have three sets of legs, which attach to the thorax. Wings (either one or two pairs) also attach to the thorax. Eyes and antennae attach to the head. Ask the students to give examples of insects, and discuss the good things that insects do.

2. Biting and stinging insects can be extremely troublesome to human beings. One thing to keep in mind is that we are not the only animals plagued by these creatures in search of blood -- all mammals are affected. Certain methods help reduce the amount of biting and stinging that actually take place. When going into areas that have heavy concentrations of biting insects, wear lightweight long sleeved shirts and long pants. Spraying bug repellent on shoes, socks, and cuffs of pants, helps to discourage chiggers. It is best to spray bug repellent on clothing instead of skin. Hats are not only good sun protection, but they also offer shielding from irritating insects.

3. Have the students go on an insect hunt. Look around the school yard for different and interesting insects. Avoid stinging and biting insects. Observe the behavior of insects. What are some of the things the students see the insects doing? Carefully capture a couple insects and put them in separate jars. In the classroom, the insects can be viewed directly through the jars. Hand lenses can be used to enlarge them. Have the students pass the jars around, and notice the basic parts of the insect that were discussed earlier: head, thorax, abdomen, legs, wings (if present), antennae (if present), and eyes. Can any of the insects' mouthparts be seen? Can any of the insects be identified as to the groups they belong to? Have the class bring the insects back outside for a release ceremony.

4. Have the students build their own insects (real or imaginary) using any or all of the following items: large wooden beads, empty spools of thread (wood if possible), wooden clothespins (especially the single piece type), pipe cleaners, sequins or beads (for eyes), and glue. Many other items could be used also. The wooden parts make great bodies, and the pipe cleaners can be used to attach body parts and to make legs, wings, and antennae. Have the students write a short story about their insects. Information that could be included in the stories would be food preference, habitat, interesting features, and survival skills. Did each student name his or her type of insect?

CREATURE FEATURES

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: All Animal-Related Activities

Objectives:

To teach students about the different and interesting adaptations of animals.

Materials:

* Copies of worksheet
* Pencils
* Index cards
* Magic markers

Method:

Discuss with the students the horseshoe crab, an ancient relic still living today. Students will learn to identify the parts of this animal using a worksheet, "Horseshoeing Around." A game will be played by the students called "Creature Features."

Background:

Animals have interesting features that allow them to function in different ways and in particular environments. Some animals have webbed feet, others have suction-cup type feet, and others have no feet at all. Animals fly, swim, burrow, walk, hop, and run. And they all have different body parts to allow them to do the things they do.

One of the most unusual creatures in the animal kingdom is the horseshoe crab. It is not a crab, or a spider, but a merostomate (mer-eh-STOE-mate), an ancient type of animal that has remained relatively unchanged for over 350 million years! The horseshoe crab is not poisonous, and it does not bite or sting. Its eyes, all four of them, are located on top of its dome-shaped shell, called a carapace. Two eyes are located centrally, toward the front, and are thought to detect light and dark, and aid in navigation. The other two eyes, which are are compound eyes (many parted structures), are located on either side of the carapace. The animal's legs, mouth, and gills are found underneath the carapace. There are five pair of legs that aid in walking, capturing food, and eating. On the animal's knees, there are teeth, which grind up food as the animal walks along, passing it down to the mouth which lies at the base of the legs. The horseshoe crab must keep moving in order to eat. Its food consists of mollusks, worms, and other invertebrates. The gills of the horseshoe crab comprise five pairs of "book" gills, each book containing up to 200 miniature gills. The horseshoe crab can swim upside down by propelling itself with its gills. The tail is primarily used as a rudder, and also as a means of righting the animal if it has been accidentally flipped over. The tail does not contain a stinger.

Background (Con't):

Horseshoe crab babies begin life as eggs, eventually hatching into larvae that bear a striking resemblance to prehistoric creatures called Trilobites. The young animals remain close to shore as they develop, and through periodic molts (shedding of the exoskeleton), they grow into adults. Horseshoe crabs are rarely eaten by people because they do not contain much meat. They are used for lobster bait. Their blood is extremely valuable because it contains an important extract called Lysate, which is used in cancer research and in the detection of spinal meningitis. To obtain blood for research, horseshoe crabs are caught in the spring, the blood is drawn, and the animals are returned alive to the sea. Horseshoe crabs may appear frightening, but actually they are harmless. They live only along the east coast of Asia, the east coast of the United States, and the Gulf of Mexico.

Suggested Procedure:

1. Discuss animal adaptations with the students. Ask them to name "creature features" that make particular animals unique. Discuss the horseshoe crab. What are some of this animal's interesting and different adaptations?

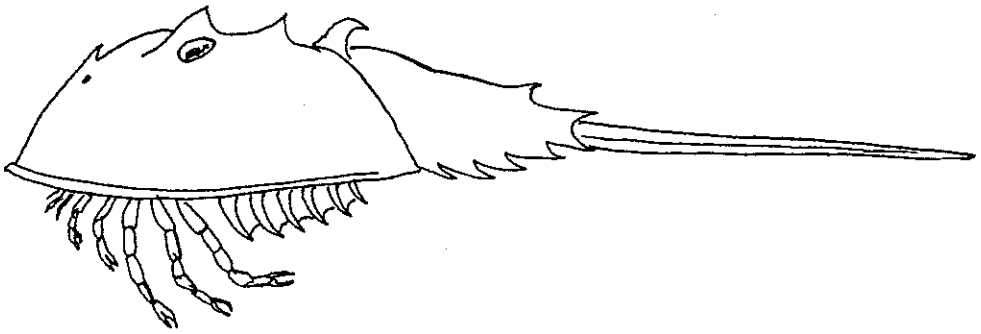
2. Have the students identify the following parts of the horseshoe crab on the "Horseshoeing Around" worksheet: lower pair of eyes, upper pair of eyes, carapace, tail, gills, and legs. Explain that the horseshoe crab's mouth is located at the base of its legs, and its teeth are actually on its knees! Discuss the answers to the identification worksheet with the class. Ask the students what is special about this creature.

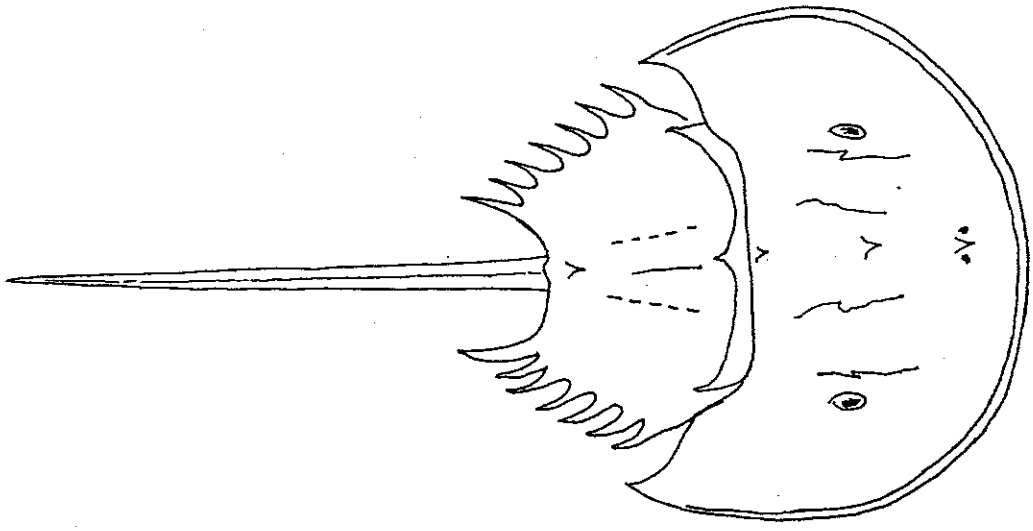
3. To play "Creature Features," index cards will need to be prepared ahead of time. On the cards, different animal features will be listed. Suggestions are given on the following page. Make three identical sets of cards. Divide the class into groups, and give each group a stack of index cards. Assign an animal to each group. Choosing animals from different groups works best, such as a mammal, a bird, and a reptile or amphibian. After the groups are assigned their animals, they will decide which of the index cards in their piles are features of their creatures. After the cards have been sorted into "yes" and "no" piles, have the groups tell the class what their creature is, and what features it has.

   This game can also be played as a race. Announce one chosen animal to the class, and all groups race to complete their "yes" and "no" piles first. The group that finishes first will read off its selections, and the other groups can speak up if they disagree. An interesting animal to use in this game is the platypus. It is a creature with a very strange combination of features.

CREATURE FEATURES

BEAK (OR BILL)
BIG EARS
BIG TEETH
CLAWS
COLD-BLOODED
EATS PLANTS (HERBIVORE)
EATS INSECTS (INSECTIVORE)
EATS ANIMALS (CARNIVORE)
EATS PLANTS AND ANIMALS (OMNIVORE)
EYES ON SIDE OF HEAD
EYES ON TOP OF HEAD
FEATHERS
FEET FOR DIGGING
FEET FOR SWIMMING
FEET FOR GRABBING
FINS
FORKED TONGUE
FUR
GILLS
HAIRY TAIL
HAIRLESS TAIL
INVERTEBRATE (NO BACKBONE)
LAYS EGGS
LEGS FOR JUMPING
LEGS FOR RUNNING
LEGS FOR CLIMBING
LONG LEGS
LONG TAIL
NIGHT VISION
POUCH
SCALES
SHELL
SHORT TAIL
SWIMS
VERTEBRATE (HAS A BACKBONE)
WARM-BLOODED
WEBBED FEET
WINGS





WHAT GOOD ARE SHARKS ANYWAY?

Subject: Science
Duration: 1 hour
Location: Classroom and Outdoors
Related Activities: The Ecological Symphony

Objectives:

To teach students about predator and prey relationships. Sharks will be discussed specifically.

Materials:

* Playing field outside
* String (or other boundary marker)

Method:

Explain to students what a predator and prey relationship is. Discuss examples. Talk about shark anatomy, behavior, and role in the environment. Students will play a game, "Sharks Alive!", to further their understanding.

Background:

Are sharks monsters, or are they just perfect eating machines? What good do sharks do? Many people believe that all sharks need to be eradicated. They fear sharks (which is understandable), and because people are occasionally killed or maimed by sharks, they feel all sharks are bad. The truth is that more people are killed by domestic pigs each year than by sharks! The number of shark attacks in any given year is very small. Yet the shark looks so horrific, it is assumed to be guilty of much more than it really is. The pig, on the other hand, looks so harmless and cute that its appearance deceives people. Sharks don't raise their young, so there are no irate shark mothers lurking in the seas, but mother sows are very dangerous on pig farms!

Predators are vital links in the food web. Sharks are a valuable part of this web. They eat vast numbers of fish and other sea creatures, helping to keep a balance of life in the seas. Sharks help to keep prey populations in balance by feeding on them and limiting their size. Sharks are in turn kept in balance by the number of prey available.

Suggested Procedure:

1. Discuss shark anatomy with the students. Draw a shark on the blackboard and identify the following: elongated body, eyes, mouth (usually with teeth), gill slits (behind eyes, usually five), dorsal fin (sometimes a second dorsal is found near the tail), pectoral fins (flippers),

Suggested Procedure (Con't):

pelvic fins (a pair of fins behind the pectoral, toward the rear of the shark), anal fin (a single fin appearing between the pectoral fins and the tail), and tail fin (tail is vertical, not horizontal like a whale's or dolphin's). A shark is a cold-blooded vertebrate. It's skeleton is not made up of bones, but of cartilage, which is very flexible. The shark has gills for breathing oxygen from the water. It is a fish, not a mammal. Most sharks must swim in order to breathe, but a few sharks are able to rest without suffocating. The largest fish in the world, the whale shark, is actually quite docile. It eats small fish and plankton, and scuba divers have been known to hitch rides on the back of this giant. Another very large and peaceful shark is the basking shark. It too feeds on plankton, which it catches by swimming through the water with its mouth open. Some sharks are very beautiful, such as the angel shark and the carpet shark. And some are very unusual looking, such as the hammerhead shark and the goblin shark.

2. Discuss shark behavior. Certain sharks will eat anything and everything. This can cause problems when people swim in areas where these sharks are found. Strange objects have been found in the stomachs of sharks, such as license plates, tin cans, bottles, even shoes. Anything that ends up in the water may end up in a shark. Not all sharks are such diverse eaters. Many sharks eat only one or two specific types of prey. Shark behavior is an area where scientists are still learning much. It used to be thought that sharks had poor vision, but researchers now feel that sharks can see very well for up to fifty feet. Sharks rely (in most cases) on their noses to lead them to food. They have an extremely keen sense of smell, and have been recorded sensing a few drops of blood from approximately a mile away. This makes sharks very frightening to us, but very efficient for themselves.

3. Play "Sharks Alive" with the students. This games stresses the relationship between predator and prey. Divide the class into two groups. One group will be the sharks, and the other group will be the fishes. The fishes will outnumber the sharks by four to one (in a class of 25, there would be 5 sharks and 20 fishes). Outside is the best place to do this activity because room will be needed for moving around. Designate a playing area about thirty feet wide by about forty feet long. Mark off the boundaries using strings or other markers. The fish will start behind one end of the playing field, and the sharks at the other. The object of the game is for the sharks to catch enough fish to eat. Each shark will have one arm outstretched, using that hand as its mouth, opening and closing fingers as it "swims." The other arm will be held behind the back of the shark to keep track of, on his or her fingers, the number of fish "eaten." When the game starts, the fish will move to the side where the sharks started, and the sharks will move to the side where the fish began. As they pass each other, the sharks will try to catch three fish. The sharks can only use the "mouth" hand for tagging the fish. Once the fish cross the end line, they are safe. Fish that are tagged have been "eaten" and must go to the sideline, where they will remain for one round. Once the sharks are at their end line, ask them how many fish they caught. Any shark that didn't catch at least three fish must go to the sideline (the opposite side from the "dead" fish) to wait until "it" is called back into the

Suggested Procedure (Con't):

game. Make sure that the "dead" fish and sharks remain far enough back from the border to not confuse the others. Play the first round.

Play a second round. Sharks must only count the amount of fish eaten in each round. This time when the sharks pass the fish, there will be quite a few less fish. More sharks will not survive this round. "Dead" sharks and fish must go to their respective sides. For the third round, bring back any fish "eaten" from the first round. Newly "eaten" fish must remain on the sideline. If there are enough fish to support an extra shark (4 to 1 ratio), then add another shark.

After a few rounds, how many sharks have survived? Are any of the first generation sharks (present since the beginning of the game) still living? Switch the sharks and the fish so that all students can try being sharks.

As a final activity, begin the game anew, but tell the class that there have been a great number of fish in the sea, so the shark population has grown. Each fish will now represent a group of five fish. The ratio between sharks and fish will now be one shark to every two "groups" of fish (two students). This time when the game begins, the sharks only need to catch one group of fish (since there are five fish in a group). At the end of the round, all "dead" fish and sharks must go to the sidelines. Most of the sharks, if not all, will probably survive the first round. Then tell the sharks that a big fishing boat has come through the area and taken away half the fish. Remove every other fish to the sideline. Begin the next round. When finished, ask the students what happened. Many sharks will have "died." Ask the students if the fish are dependent upon the sharks. The answer would be no -- they can survive without the sharks. Then ask the students if the sharks are dependent upon the fish. This answer is yes. This is the essence of the predator/prey relationship. The number of predators is directly related to the amount of prey available.

THE FREE SPIRITED DOLPHIN

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: Creature Features

Objectives:

To teach students about dolphins, their basic body structure, and behavior.

Materials:

* Copies of worksheet
* Pencils

Method:

Discuss dolphin anatomy with the students. Explain how dolphins are classified. The students will circle words relating to dolphins in the "Daring Dolphins Wordfind."

Background:

Dolphins are fascinating creatures. Human beings feel very "connected" to dolphins and usually treat them with the highest regard. Part of this connection has to do with the fact that research has shown dolphins (and other whales) to be very intelligent. Dolphins are not fish, but whales. Dolphins, and other whales, are called cetaceans (set-a-shuns). All cetaceans are warm-blooded vertebrates that breathe air and nurse their young. Cetaceans breathe using blowholes, located on the tops of their heads. They can swim to great depths, but they must return to the surface for air. Dolphins are placed in the suborder odontoceti (o-dont-o-set-e), meaning toothed whales. Dolphins usually have long beaks, whereas porpoises have no beak that is visible. Researchers often refer to dolphins as porpoises in order to avoid confusion over the fact that there is a fish called the dolphin as well.

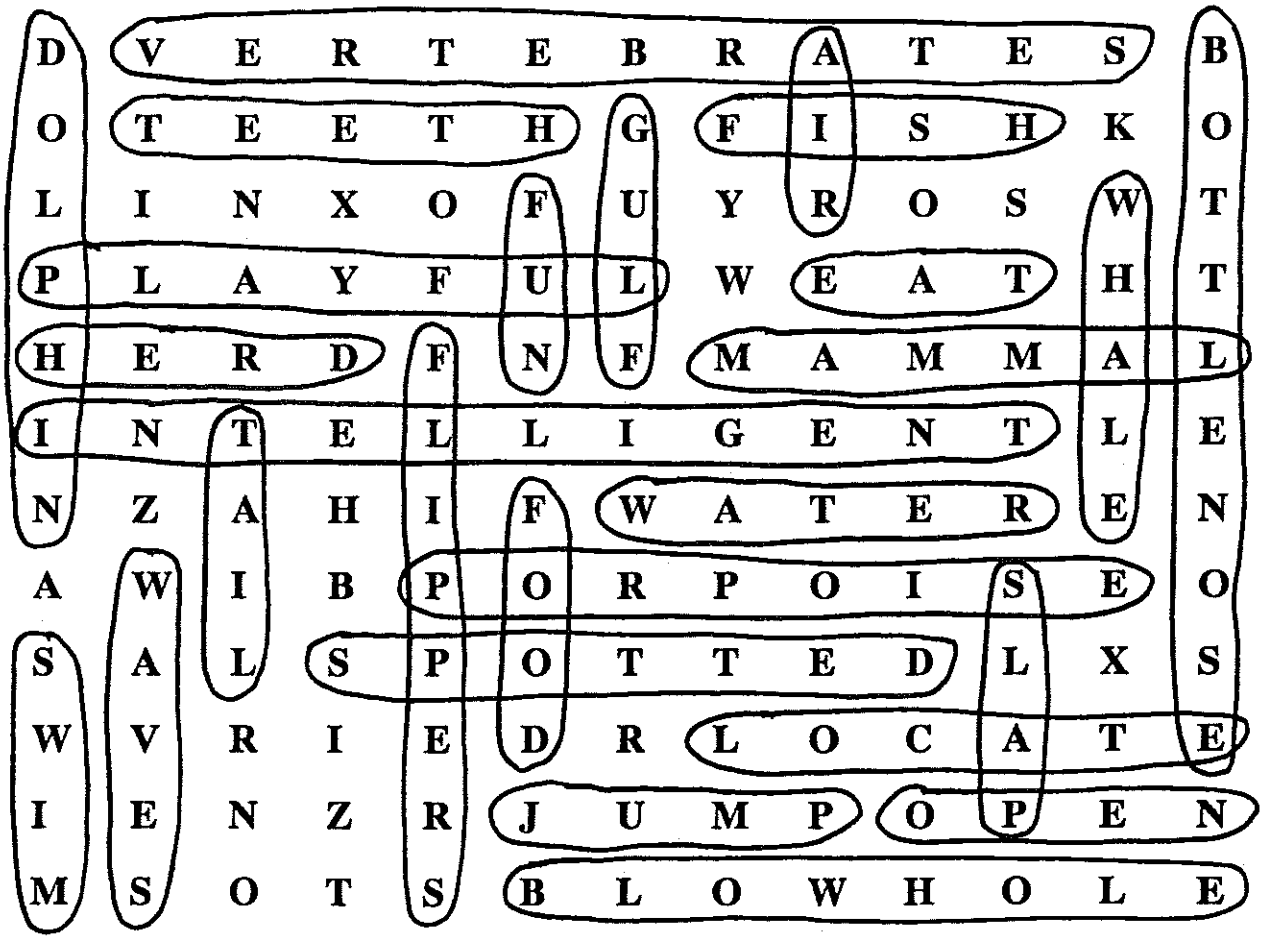
One of the ways people see dolphins is by going out on boats. Dolphins often play in the wakes made by boats, or ride on the bow waves. When a dolphin "bow rides," it strategically places itself in front of the boat, and rides along in the water being pushed forward by the bow. This way it gets a "free" ride. The dolphin may twist and turn and at times leap out of the water. Pelorus Jack was a very famous Risso's dolphin that lived in New Zealand. Risso's dolphins were rare in New Zealand, and Pelorus Jack was the only one in the Marlborough Sounds. Pelorus Jack led the ferry boat from French Pass to the Cook Strait, where he met another ferry coming the other way. There he changed ships, and guided the other boat back to port. People fell in love with Pelorus Jack, and the New Zealand government decided to protect all Risso's dolphins. An American newspaper ran a story stating that Pelorus Jack was "the only fish in the world protected by an Act of Parliament." Of course he wasn't a fish, but Pelorus Jack was a star in the Marlborough Sounds for almost twenty years.

Suggested Procedure:

1. Discuss dolphin structure with the students. Draw a picture of a dolphin on the blackboard. Identify the elongated body, the beak (using a bottlenose for an example), the mouth, the teeth, the eyes, the blowhole (on the top of the head, above the eyes), the dorsal fin (along the center of the back), the tail (also called the fluke -- is horizontal to the water, not vertical like a sharks'), and the flippers. Have any of the students ever seen bottlenose dolphins? They are the most common dolphin in the Gulf of Mexico. Explain to the class how dolphins are classified, and that they are whales, not fish.

2. Have the students play the "Daring Dolphins Wordfind." They will circle words in the letter grid that appear, in capital letters, in the short story about dolphins. Discuss the answers with the class. Do any of the students have any interesting dolphin facts to share with the class?

DARING DOLPHINS WORDFIND - ANSWERS



DARING DOLPHINS WORDFIND

D	V	E	R	T	E	B	R	A	T	E	S	B
O	T	E	E	T	H	G	F	I	S	H	K	O
L	I	N	X	O	F	U	Y	R	O	S	W	T
P	L	A	Y	F	U	L	W	E	A	T	H	T
H	E	R	D	F	N	F	M	A	M	M	A	L
I	N	T	E	L	L	I	G	E	N	T	L	E
N	Z	A	H	I	F	W	A	T	E	R	E	N
A	W	I	B	P	O	R	P	O	I	S	E	O
S	A	L	S	P	O	T	T	E	D	L	X	S
W	V	R	I	E	D	R	L	O	C	A	T	E
I	E	N	Z	R	J	U	M	P	O	P	E	N
M	S	O	T	S	B	L	O	W	H	O	L	E

Circle the words above that are listed below in capital letters:

A **DOLPHIN** is also called a **PORPOISE**, but it is <u>not</u> a **FISH**. It is a member of the **WHALE** family. Dolphins have **TEETH**, so they are called toothed whales. Dolphins are **VERTEBRATES**, because they have backbones. A dolphin is a **MAMMAL**. It breathes **AIR** through its **BLOWHOLE** and nurses its young. **BOTTLENOSE** dolphins are commonly found in the **GULF** of Mexico. Sometimes **SPOTTED** dolphins are seen there too. Dolphins can **SWIM** fast, and can use sonar to **LOCATE** their **FOOD**. Dolphins are considered to be very **INTELLIGENT** and may form a large group to **HERD** together schools of fish to **EAT**. Dolphins are very **PLAYFUL**, and they have been seen using their **FLIPPERS** to **SLAP** the water. Sometimes they even stand up and **TAIL** walk across the **WATER**! We especially like to think of dolphins having **FUN**, when they **JUMP** gracefully through the **WAVES** made by boats visiting their territory, the **OPEN** water.

NIGHT SOUNDS

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: In the Air -- Birds!

Objectives:

To teach students about sounds that are heard during the night.

Materials:

* Tape recorder
* Blank tape(s)

Method:

Students will listen to tapes of sounds made in the night and try to determine the sources of the sounds.

Background:

The sounds of the night have raised many a hair in trepidation. A branch of a tree, rubbing against another, may produce a squeal or squeak. Wind blowing through tall pines can sound like a jet engine readying for take-off. A barred owl, tiring of its regular "Who cooks for you, who cooks for you all" call, may begin making monkey-like noises or shrieking sounds. All these sounds and others can add up to an uneasy experience when walking in the dark -- unless the sources are known and understood. Once unfamiliar sounds can be identified, it becomes fun and challenging to try to hear more sounds, new sounds, unknown sounds.

The best way to learn sounds and noises is to begin with a familiar group of sounds that can be identified. The wind whistling through the trees is a sound known by all. This is a good "first" for a person's "sound library." Then add another, and another, and pretty soon the library has expanded to contain a great number of things "that go bump in the night."

Suggested Procedure:

1. Make a tape of sounds heard in the night. It would be ideal to make two tapes -- one from a city, and another from the country. Ask students who live in urban and rural areas to make tapes and bring them to class.

   When listening to the tapes, turn out the lights in the room, and pull the shades. Have the students put their heads on their arms. Play the tapes and have the students try to recognize as many different sounds as possible. Were any of the sounds scary? Were any familiar?

Suggested Procedure (Con't):

Now turn the lights on and play the tape back. Identify the sounds one at a time. The students can list the sounds they heard on the "What's That Noise?" worksheet.

If a second tape was made, play it in the same way. Compare the two tapes. Were sounds heard from animals, machines, wind, weather, people? What were the differences between the urban tape and the rural tape? Ask the students if they felt different listening to the sounds in the dark versus listening to them with the lights on.

Have the students imagine some specific sounds that they didn't hear on the tapes. For example: rain falling on the roof of a car, a waterfall, a coyote howling, thunder and lightning. These noises are already in most people's "sound" libraries. Ask the students to listen to new sounds whenever possible, thus expanding their "sound" knowledge.

2. Discuss the word "nocturnal" with the students. Ask them if they can identify any animals that are nocturnal. Some of the animals that come out at night are: bats, raccoons, opossums, armadillos, deer, foxes, coyotes, owls, weasels, certain insects, rodents, snakes, amphibians, lizards, and people who work night shifts. Discuss some of the sounds these creatures might make. What are the advantages for these animals in coming out at night? What predators hunt by night? How do they see in the darkness? Ask the students if they would rather be a day person or a night person and why.

3. Have the students write a short story about the most unusual noise they ever heard at night. Ask the students to share their stories with the class.

WHAT'S THAT NOISE?

I HEARD THESE SOUNDS ON THE TAPE:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____

HERE TODAY, GONE TOMORROW?

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: The Ecological Symphony

Objectives:

To teach students what it means to be an endangered or extinct species.

Materials:

* Lists of endangered and extinct species
* Pictures of extinct species
* Paper
* Pencils

Method:

Discuss the words "endangered" and "extinct" with the students. Have a Memorial Day for extinct species. Each student will research and write a small report about a currently endangered species living in the area.

Background:

Extinct is forever. That is why people work so hard to help endangered species (species in immediate danger of becoming extinct). Species diversity is not only pleasing to people, it is very important. Every plant and animal fills a niche in the food web. If a species disappears, a hole will be left in its place. Too many holes, and the food web might break down. Species are also important for scientific discovery. Many medicines and cures for illnesses come from wild plants and animals. There is still much information that can be learned from ecosystems such as rainforests. Scientists can now monitor the populations of individual species and determine if a problem exists. Finding out about the problems is the first step; helping to solve them is the next. Many individuals and organizations work together to help species when they are considered endangered. Solutions have been devised to help once endangered species become reestablished again. Species can decline due to many different factors: loss of habitat; pollution; overuse of pesticides; loss of a prey species; over-consumption of a species for commerce, food, or sport; diseases; and predation. Studying the effects of these various factors on plant and animal populations is one of the ways scientists determine if a species needs help. In order to save species, they need to be identified, studied, and understood. Once we know what we have, we know what we stand to lose.

Suggested Procedure:

1. Obtain a federal or state list of endangered and/or extinct species. The federal list is available by writing:

   U.S. Fish and Wildlife Service
   The Publication Unit
   4401 North Fairfax Drive (130 Webb)
   Arlington, VA 22203

   Or by calling (202) 208-5634. The Fish and Wildlife Service also has "biologues" on specific endangered species.

   State lists are available from State Departments of Wildlife. For information in Florida write to:

   Florida Game and Freshwater Fish Commission
   Division of Wildlife
   620 South Meridian Street
   Tallahassee, FL 32399-1600

   Or call them at (904) 488-3831. For information in Mississippi write to:

   Mississippi Department of Wildlife, Fisheries, and Parks
   The Museum of Natural Science
   111 North Jefferson Street
   Jackson, MS 39201

   Or call them at (601) 354-7303.

   The National Park Service also works to help protect endangered species. Gulf Islands National Seashore monitors bald eagles, beach mice, brown pelicans, sea turtles, and other endangered animals and plants.

2. Discuss with the students the definitions for the words extinct and endangered. Tell them that extinct plants and animals are gone forever, while endangered species are still here, but in need of help. Ask the students if they know of any extinct or endangered species. Good examples of extinct species that are native to the Southeast are the passenger pigeon and the carolina parakeet. Both of these birds were abundant during their lifetimes. It is thought that shooting and loss of habitat contributed to their extinctions. Among species endangered today are the bald eagle and the brown pelican. These animals were seriously affected by the pesticide DDT. They ingested DDT by eating fish contaminated with the poison. This caused the birds to lay eggs with very thin shells. When the parent birds sat on the shells to incubate

Suggested Procedure (Con't):

them, the eggs broke. As a result, very few bald eagles and brown pelicans were being born, and their populations crashed. Researchers found out the cause for these animals' decline, and worked to have DDT banned. Today populations of bald eagles and brown pelicans are expanding.

3. Have the students plan a Memorial Day for extinct species. If pictures can be found of extinct species, make them available to the students. Discuss some of the species that have become extinct. Explain that sometimes extinction occurs naturally. Recently, though, extinction is happening rapidly due to human influence. This is why there is so much research being done regarding endangered species.

4. Have each student select a species that is locally endangered (within the state). Tell the students that they will research their endangered species and write reports about them. Have the students find out information about the species such as: habitat, diet (nutrients in the case of plants), appearance, life span, reason for decline, and what is being done to help. The students can share their reports with the class.

5. An additional activity that can be done with the class is to "adopt" an endangered species. Many wildlife organizations and zoos have such programs. It usually costs about $25.00 for the year. The students will be sent information on their "adoptee," as well as updates on their animal's activities throughout the year. For information write:

American Association of Zoological Parks and Aquariums
4550 Montgomery Avenue, Suite 940N
Bethesda, MD 20814

Or contact your local zoo or conservation organization.

NO HANDOUTS ALLOWED

Subject: Science
Duration: 1/2 hour
Location: Classroom
Related Activities: Top Dog -- The Alligator

Objectives:

To teach students that feeding wildlife can be harmful to both animals and people.

Materials:

* Enclosed story

Method:

Discuss with students the reasons why it is best not to feed wildlife. Explain that for certain animals, feeding by humans can make them dangerous. Read aloud the story of "Alphonse, Everyone's Favorite Alligator."

Background:

Wild animals are just that -- wild. Sometimes it is easy to forget that a cute raccoon or fox that comes to a back door begging for food could actually bite the hand that feeds it. These animals are wild, and being so, they are used to foraging for food on their own. As human development spreads, contact with wild animals increases. Animals are great fun to watch, and food becomes a way to lure them closer and to have a longer view. This is potentially dangerous for both parties. Wild animals that are fed by humans will begin to associate food with all humans, not just with the person or persons who fed it initially. The animals may begin to look for handouts from people who have no intention of feeding them, and unfortunate accidents may result. Wild animals have basic instincts to hunt and search for food. When humans intervene with these instincts, animals may become too reliant on handouts for their own good. Certain animals that are fed by people can be exceedingly dangerous. Bears and alligators are capable of severe harm to people, especially children. They do not seek out people as food, but the increasing contact that comes with feeding these animals makes accidents more likely to happen.

It is wonderful to watch animals in the wild. Some wild animal sightings can be the most rewarding experiences in a person's life. So let's all work together to keep them wild, and please remember -- no handouts allowed.

NO HANDOUTS ALLOWED

Suggested Procedure:

1. Discuss with students some of the reasons why it is not good to feed wild animals. In National Parks, wildlife abounds. There are creatures of every shape, size, and type. People come to National Parks for many reasons, but especially to watch the wildlife. It is tempting to lure wild animals close with food to watch and photograph them, but in a National Park this is illegal. Parks impose stiff fines on people who are caught feeding or harassing wildlife, and with good reason. It is dangerous when wildlife becomes tame or learns to associate food with visitors. Accidents can occur, hurting people and animals, and at times, the result can be death. A good rule to follow everywhere: watch, photograph, admire, and inquire about wildlife, but do not feed the animals.

2. When discussing why it is important not to feed wildlife, the issue of bird feeding may come up. This is a national pastime, for good or for bad. Millions of people enjoy feeding birds and watching them. There are many theories pro and con regarding bird feeding. On the negative side, bird feeding may upset birds' migratory urges, and if feeders aren't kept clean, the birds that use them may get sick. On the positive side, bird feeding is entertaining and educational (and it stimulates interest in nature and wildlife conservation); birds are usually fed seeds that they can also find in the wild; and birds (contrary to what you may have learned from Alfred Hitchcock) are not generally dangerous to humans.

3. Read the story "Alphonse, Everyone's Favorite Alligator" to the class. Explain to the students that this is a make-believe tale (alligators do not really think or talk like people) written to illustrate why it is not good to feed wild animals. Discuss the story with the class. Ask students what it would be like if strangers handed them food all the time. It wouldn't be very healthy for them, because chances are good that they wouldn't be eating balanced diets. Animals need balanced diets just like people do, and in the wild they know how to eat to fulfill their own needs.

NO HANDOUTS ALLOWED

ALPHONSE, EVERYONE'S FAVORITE ALLIGATOR

by Debbie Kanze

An alligator is a magnificent creature. And Alphonse was no exception. He was the favorite attraction in the Park. Everyone loved to go see him. Alphonse had a particular pond that he called his own. When people came to visit, he was very happy. Alphonse might be found sunning himself along the side of the marsh. Or he might be submerged in the water with only his eyes and nose peeking out, pretending to be a log. Or he could be moving through the water, swinging his tail from side to side gracefully. Whatever he was doing, he was captivating.

One day, people realized that they could get Alphonse to come closer to them by throwing food in the water. Alphonse would quickly swim over, open his huge gaping mouth with large pointy teeth, and munch on the offerings until they were gone. People enjoyed seeing him do this. The word spread, and soon lots of people were coming to the pond to feed Alphonse. Of course, there was a sign posted that said that it was dangerous to feed the alligators, but most of the people ignored it. "Alphonse loves us," they thought. "He wouldn't harm us."

Alphonse thought that he had it pretty good in his current situation. He was getting all these tasty tidbits, and lots of attention. He loved attention more than anything. Even more than the food. After all, they weren't feeding him frog legs or fish fillets, they were feeding him popcorn and marshmallows! Alphonse had a sweet tooth, so he just couldn't resist the handouts.

Everything seemed to be going along fine -- until one awful morning when Alphonse woke up with the worst toothache of his life! He'd gotten things stuck in his teeth before, but nothing ever hurt him like this. All he could do was lie on the side of the marsh, rolling around in the grass, moaning and groaning. Some concerned people came by and saw Alphonse. They quickly got a Park Ranger and asked what was wrong with Alphonse. The Ranger could not answer the question, so a veterinarian was called.

When the veterinarian arrived, Alphonse was crying and hiding in his burrow. He asked the doctor not to let anyone see him like this. The doctor examined Alphonse, and told the Ranger what was wrong. "His teeth are full of cavities, and beginning to rot," the doctor stated sadly. "I'm afraid they will have to go." "Go, what do you mean go?" asked the Ranger. "They will have to be pulled -- all of them," said the doctor. With that the doctor and the ranger looked at Alphonse, and the doctor asked, "What have you been doing Alphonse, eating popcorn and marshmallows?" Alphonse was so humiliated he just turned his head and sighed.

ALPHONSE, EVERYONE'S FAVORITE ALLIGATOR (CON'T)

The doctor pulled all of Alphonse's teeth and then told him that now he was going to have to live in a zoo. Alphonse was going to be put on a special diet, and he would need to go where he could be taken care of. He was sent on a boat to the New Orleans Zoo, where he lived with many other alligators. The other alligators all had their teeth, so they were able to eat regular meals. But Alphonse had to eat soft and mushy things, like frog puree and squished fish. He missed his pond at the Park and all of his natural surroundings. He wished he could go back, but he knew it was impossible. So instead, he made the best of things at the Zoo. He took this opportunity to tell everyone: "Please don't feed the wildlife -- we are much happier being wild."

The End

THE TREES AROUND US

Subject: Science
Duration: 1 hour
Location: Classroom and Outdoors
Related Activities: Let's Go Recycling, Make Your Own Paper

Objectives:

To teach students about trees; their structure, needs, and benefit to the environment.

Method:

Discuss tree structure with the students. Explain how trees "inhale" carbon dioxide and "exhale" oxygen. Students will "Adopt-A-Tree" (observe and write a report about a tree of their choosing).

Materials:

* Paper
* Pencils
* Brads
* Hole punch
* Tape or glue
* Clear contact paper (if possible)
* String
* Ruler

Background:

Even though we rarely think of them as such, trees are wildflowers. They are woody plants that have flowers, leaves, and stems (branches and trunks), and grow more than six feet tall. (Any woody plant under six feet tall is considered a bush). Some trees are so tall that it is very hard to see their flowers. But if you look carefully, at the right time of year, the flowers are there. Trees are very important to people. Not only do we enjoy looking at them, walking through forests of them, and using them for paper and lumber, but trees provide us with oxygen. All green plants do. They perform this amazing trick using carbon dioxide, some oxygen, chlorophyll (from inside the plant), water, and sunshine. Sugars and starches are created to "feed" the plant, and oxygen is released into the air as a waste product. More oxygen is expelled than is used by the plant. This process is called photosynthesis. In the United States, there are three major types of native southeastern trees -- needle-bearing trees, broad-leaved trees, and palm trees. The needle-bearing trees, which are also called conifers, produce needle-like leaves and seed-bearing cones. The broad-leaved trees (which make up the majority of tree species in North America) have wide, flat leaves and produce fruits that contain seeds. The palms have large fan-shaped leaves and also produce fruits. People eat many of the fruits produced by trees, such as: pears, apples, plums, bananas, and nuts. Our planet is greatly benefited by trees, and as individuals we use trees every day. So thank a tree today and give it a hug -- without trees where would we be?

Suggested Procedure:

1. Discuss tree structure with the students. Draw a tree on the blackboard. Identify the following parts: roots, trunk, branches, leaves, and cones or fruits (which are produced after the flowers bloom). Discuss the fact that a tree takes up water and nutrients through its roots. Explain to the students that leaves on a tree perform photosynthesis to make food for the tree.

2. Ask the students to name as many things they can think of that come from trees. Discuss tree conservation and why it is important to have forests of trees. There are many ways that people can save trees. Conservation of resources is a great start. Save paper whenever possible, save old lumber to be used for another project, and don't overuse paper plates, napkins, towels, etc. Recycling is a way to reuse paper, instead of always taking it directly from trees. In the appendix you will find recycling projects to do in the classroom. An amazing tree statistic is that if Americans recycled all their Sunday newspapers, over 500,000 trees would be saved every week! Let's start recycling today.

3. Have each student "Adopt-A-Tree." A tree can be chosen from the schoolyard or at home. Tell the students to pick a tree, not a bush. A tree will be over six feet tall. The students will observe their trees and keep journals about them. In the classroom, the journals can be put together like a book, one page at a time. Attach the pages using brads. Have the students study the following things about their trees.

   What does the tree look like? Have the students describe their trees in as much detail as possible. Are there any unusual growths or marks on the tree? What is the environment around the tree like? Have the students sketch pictures of their trees. What is the trunk like? How does the tree branch? The drawings can be used as the covers for the students' journals. Have the students write titles for their journals and put their names underneath as the authors.

   Collect a leaf (or group of needles) from the tree. The leaf can be collected from the ground if one cannot be reached, but be sure to have the students check that leaves picked off the ground are the same as those growing on the trees. (Please tell the students collecting of any kind is not allowed in a National Park). Is the tree a broad-leaved tree, a needle-bearing tree, or a palm tree? If the tree is a broad-leaved tree, what do the edges of the leaf look like? Does it have jagged edges? If so, the leaf is referred to as <u>toothed</u>. Does the leaf have sections that look like they've been cut out? If so, the leaf is <u>lobed</u>. If the leaf is not toothed or lobed, then it is considered smooth-edged. Leaves can be lobed, toothed, lobed and toothed, or smooth-edged. If the tree is of the needle-bearing group, and the needles are organized in clumps, how many needles are in each clump? If the tree is a palm, the leaf will be large and fan-shaped. What do the leaves feel like? Are they shiny or dull?

Suggested Procedure (Con't):

Have the students mount their leaves on paper or preserve them by pressing the leaves between clear contact paper or ironing them between waxed paper. Have the students write down any information they learned about their leaves.

Take a rubbing of the bark. Place a piece of paper over the bark of the tree, and using a pencil, rub back and forth to get a picture of the texture of the bark. Smooth-barked trees will not show as much change as rough-barked trees. Have the students feel the bark of their trees and write about their sensations. Add the pictures and observations to the students' journals.

What other parts of the tree are visible? Are there buds, cones, flowers, fruits (such as berries, nuts, and acorns), seeds, or any other noticeable parts? Collect samples of these items from underneath the tree. Have the students sketch the different parts, and add the drawings to their journals.

Take measurements of the tree. Have the students measure the circumference of their trees (explain this term for the students, and tell them it would be like taking a measurement around their shoulders) using a piece of string. The lengths of the strings can be measured in class. Have the students estimate the height of the tree. How many times their own heights are their trees? Are the trees taller than the students' houses? How many times taller than their houses? Whatever objects the students use to judge the size of their trees, they need to find out the height of the objects, and estimate how many times that height their trees are. In class, the mathematics can be done to calculate the trees' heights. Have the students add this information to their journals.

Observe other life on the tree. Have the students watch their trees and see if they can find other plants and animals living on the trees. Tell the students not to touch the plants growing on the tree -- poison ivy may be present! Are there fungi on the trees? Are mosses or lichens growing on the tree or around the base of it? What insects can be seen on the tree? Are there holes in the tree? Are animals living on or visiting the tree? Have the students write down all of their observations in their journals.

Watch the tree during different seasons. Many changes take place on a tree throughout the year. Leaves may change color and fall off, cones or flowers will develop, fruits or seeds will grow, and the tree will grow larger. Have the students visit their trees during different seasons and record observations in their journals.

Suggested Procedure (Con't):

What does the tree provide the environment? Have the students write short stories about their trees. Include things that the tree provides other plants and animals. How does the tree affect the student who has "adopted" it? These stories will serve as epilogues for the students' journals.

4. Plant a tree as a classroom project. This can be done for Arbor Day, or any other day as well. Certain nurseries or conservation groups might provide a tree at no charge. Have the class write a letter and ask if this would be possible. One place to start is the American Forestry Association, Global ReLeaf Program, P.O. Box 2000, Washington, DC 20013. For information on Arbor Day write to: National Arbor Day Foundation, Arbor Lodge 100, Nebraska City, NE 68410. The students could decide (from a list of possibilities) what type of tree they would like to plant. An area will have to be agreed upon as the new location for the tree. Get together as a class and plant the tree. Each student can take turns helping to dig the hole, plant the tree, and fill in around the roots. Invite the students to admire their tree and realize that they have made a positive contribution to their environment.

BAYOUS, BAYS, AND SOUNDS

Subject: Science, Geography
Duration: 1 hour
Location: Classroom
Related Activities: Locating Gulf Islands National Seashore

Objectives:

To teach students the difference between bayous, bays, and sounds.

Materials:

* Copies of map worksheets
* Pencils
* State maps of Florida and Mississippi
* Gulf Islands National Seashore brochure

Method:

Discuss the characteristics of different bodies of water -- specifically bayous, bays, and sounds. The students will identify local bodies of water on maps.

Background:

Bayous, bays, and sounds are bodies of water that are present in and around coastal areas of the Gulf of Mexico. Sounds are elongated bodies of water that usually run parallel to the coast and are separated from the sea by one or more islands. Bays are inlets of water that are surrounded by land except where they empty into the sea or a sound. Into bays, sounds, and the Gulf of Mexico, bayous flow. Bayous are usually tributaries of larger rivers or other bodies of fresh water. They are slow moving and full of twists and turns. Bayous, bays, and sounds are all affected by the tides and currents of the Gulf. Further inland, conditions are different than along the coast. The salinity is lowered because salt water from the Gulf is mixed with fresh water from rivers and rainfall. The affects of the tide grow smaller and smaller. The vegetation changes. Two dominant species of plants, salt marsh cord grass and black needle rush, thrive in the saltiest water. As the water slowly becomes mixed with fresh water, more plants can grow. Eventually salt tolerant plants give way to fresh water plants, including trees. Cypress trees may grow right out of the water, knees spreading in every direction. People often visit these watercourses for recreation and sightseeing.

Suggested Procedure:

1. Discuss the definitions of bayous, bays, and sounds with the students. Ask them if they can give examples of bayous, bays, and sounds. Have any of the students ever visited any of these bodies of water?

Suggested Procedure (Con't):

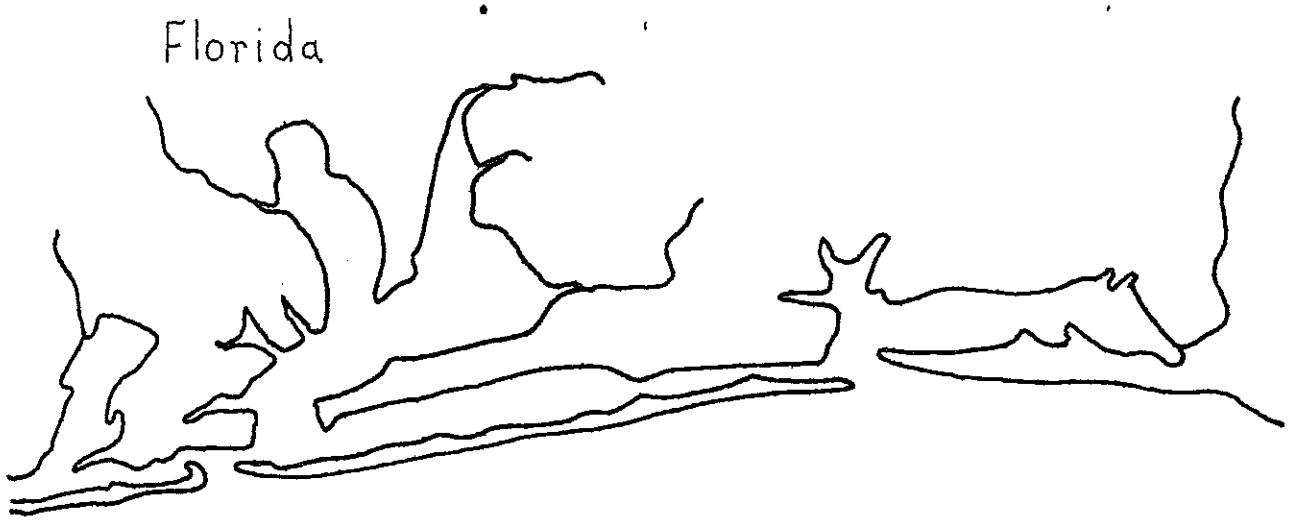
2. Explain to the students what salinity means. Discuss how the Gulf of Mexico has a higher salinity than inland waters. This is because inland waters are fed by freshwater and rainwater. These smaller bodies of water dilute the water from the Gulf that flows into them and also send some of their "fresher" water into the Gulf. Ask the students where they think the waves are biggest: in the Gulf, in a sound, in a bay, or in a bayou. The correct answer is the Gulf. The sounds are protected from the full power of the waves by the barrier islands. Bays which are further inland have little wave action, and bayous which wind, twist, and turn have the least wave action of all.

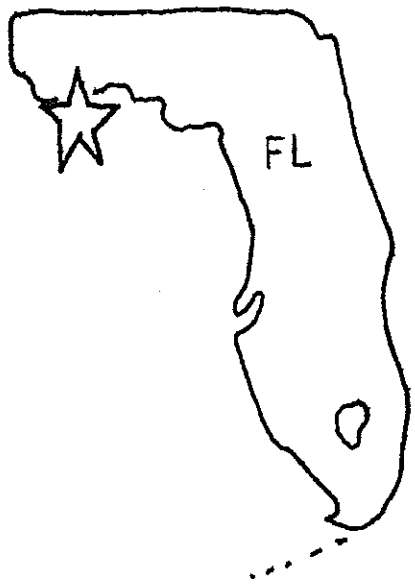
3. Write the names of the bodies of water listed below on the blackboard, then have the students identify them on their maps.

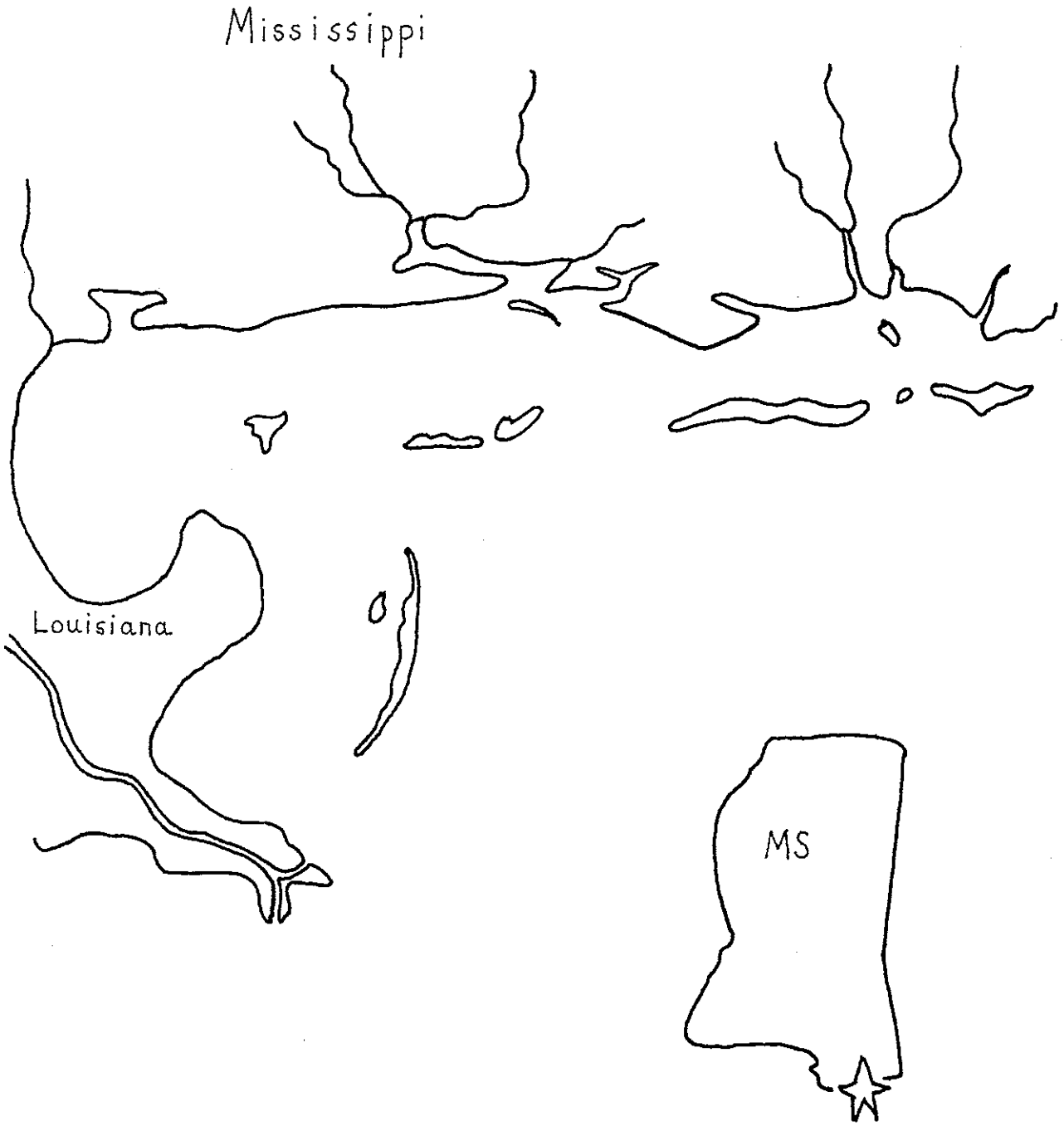
   Worksheet maps show Florida and Mississippi coastal lands and waters.

Florida Bodies of Water	Mississippi Bodies of Water
Gulf of Mexico	Gulf of Mexico
Santa Rosa Sound	Mississippi Sound
Choctawhatchee Bay	Bay St. Loius
East Bay	Back Bay of Biloxi
Escambia Bay	Biloxi Bay
Pensacola Bay	Big Lake
Perdido Bay	Bayou Casotte
Bayou Chico	Davis Bayou
Bayou Grande	Halstead Bayou
Bayou Texar	Stark Bayou

Allow the students to use whatever maps or information they need to locate these bodies of water on their worksheets. Once the maps are completed, discuss the answers with the class.


Florida


FL


Mississippi
Louisiana
MS

WHAT CAUSES THE TIDE?

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: Who Lives in The Sand?

Objectives:

To teach students what makes tides happen.

Materials:

* Copies of worksheet
* Pencils
* Crayons (optional)

Method:

Discuss the definition of a tide. Explain how the moon creates the tides. Afterwards, the students will fill in a "Tidal Inhabitants" worksheet.

Background:

The gravitational pull of the moon upon the earth is the primary cause of the tides. Wherever the moon faces the earth, there is a high tide. This tide is caused by the gravitational force of the moon attracting the water toward it. At the same time, on the other side of the earth there is also a high tide. This tide is caused by the force of the moon acting on the earth below the water. The moon is pulling the earth away from the water that lies on the opposite side of it. This causes the tide to be high because the ground below it has "sunk." The waters in between the areas of high tide, will be either heading toward low tide, at low tide, or rising from low tide toward high tide. As the earth rotates the tides will ebb and flow along with the moon's gravitational force. Since the earth rotates completely around once every day, in most places there are two high and two low tides each day (each type of tide happening at opposite ends of the earth simultaneously). In only two places in the world, in parts of the northern Gulf of Mexico and parts of the China Sea, there are only one high and one low tide each day. Scientists speculate why this is so, and in the Gulf of Mexico they feel that it has to do with the size and shape of the Gulf and the currents running through it.

Suggested Procedure:

1. Discuss the meaning of "tide" with the students. Tell them that tides are rising and falling levels of ocean water, especially visible along the shoreline.

Suggested Procedure (Con't):

2. Draw a picture of the moon pulling the tides on the earth (other forces also affect the tides, but to a much lesser degree). Use the enclosed diagram for a reference. Discuss the effects of the moon on the water and on the earth. Tell the students that the earth rotates completely around its axis once every twenty-four hours. Ask them how many tides would occur each day. Explain that in the northern Gulf of Mexico there are only two tides per day, one high and one low.

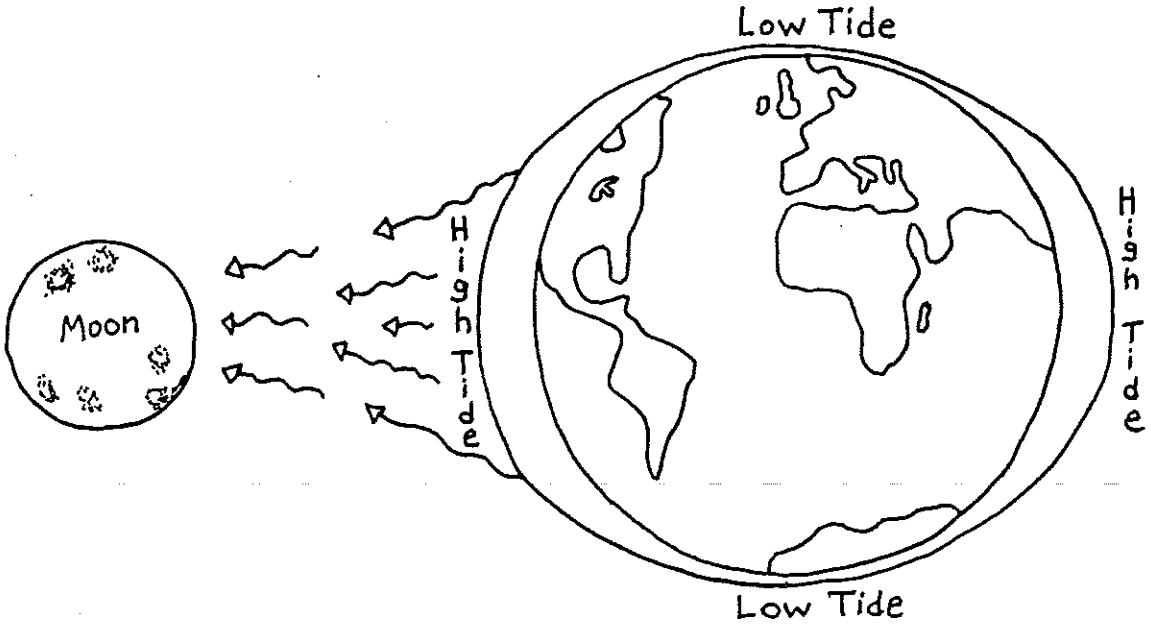
3. Have the students fill in the "Tidal Inhabitants" worksheet. On the first page, the students will identify creatures that come out at low tide in a salt marsh. The names of the animals to be identified are listed beneath the picture. The second worksheet depicts the salt marsh at high tide. On this worksheet students will draw pictures to show where the previously identified animals might go when the tide comes in.

Possible answers for the high tide worksheet:

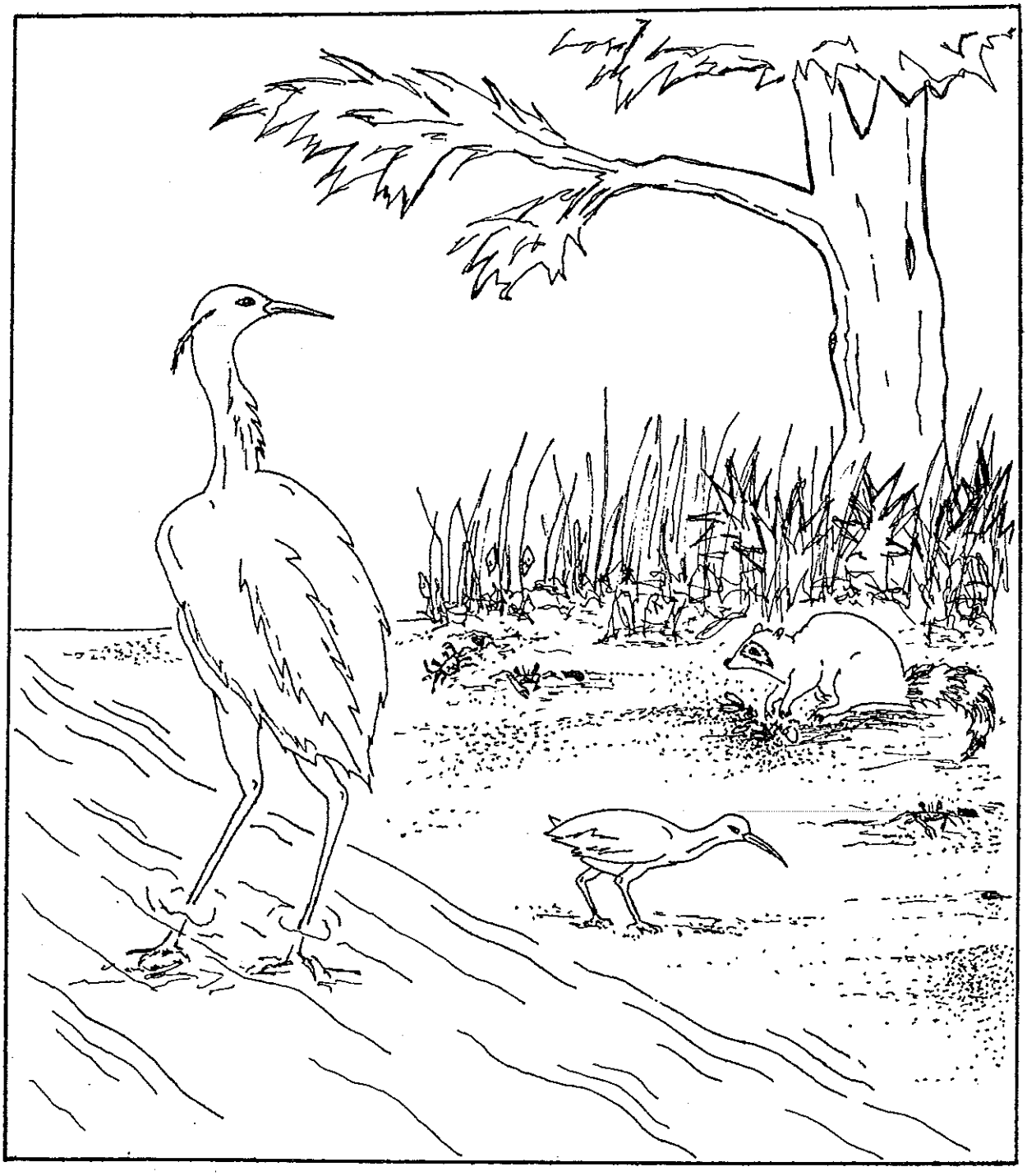
Clapper Rail	-	moves into grass
Great Blue Heron	-	flys away
Fiddler Crabs	-	retreat into burrows in the mud (which eventually are under water)
Marsh Periwinkles	-	climb up blades of grass
Raccoon	-	moves into forest, climbs tree

4. Have the students color in their worksheets if desired.

WHAT CAUSES THE TIDE?



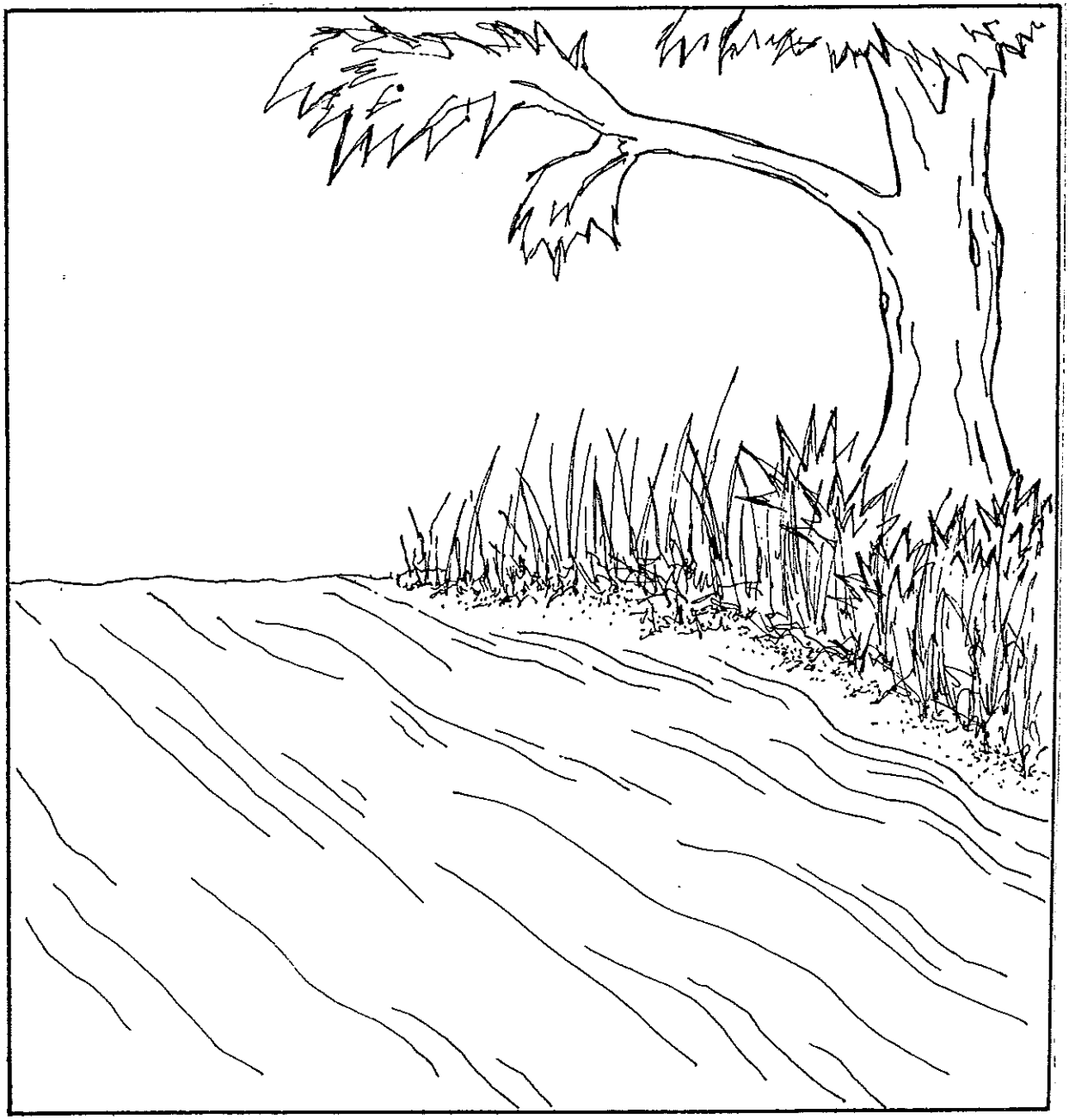
TIDAL INHABITANTS



IDENTIFY THE FOLLOWING ANIMALS IN THE PICTURE ABOVE:

CLAPPER RAIL
FIDDLER CRABS
RACCOON
GREAT BLUE HERON
MARSH PERIWINKLES

TIDAL INHABITANTS



DRAW IN THE ABOVE PICTURE THE FOLLOWING ANIMALS IN PLACES WHERE THEY MIGHT HAVE GONE WHEN THE TIDE CAME IN:

CLAPPER RAIL
GREAT BLUE HERON
FIDDLER CRABS
MARSH PERIWINKLES
RACCOON

WHAT GOES UP, MUST COME DOWN

Subject: Science
Duration: 1 hour
Location: Classroom and Home
Related Activities: Weather Changes

Objectives:

To teach students about the water cycle and why water is a precious commodity.

Materials:

* Paper
* Pencils

Method:

Discuss the water cycle with the students. Explain how water is obtained for our use. The students will learn why water conservation is important, and how they can help.

Background:

On earth, water is a life-sustaining substance for all plants and animals. Without it, all living things would perish. The water on the earth exists in a closed system; there is a finite amount of it. No new supply of water is added to what is already present. Water is simply recycled over and over again. The water cycle is constantly moving water around by methods of evaporation and precipitation. The sun heats the waters on the earth, and they evaporate. The evaporating water vapor joins previously evaporated water vapor in the air. As the amount of water vapor grows, and as the air rises and cools, clouds form. Clouds are created as evaporated water vapor condenses, forming droplets of water. When the air cools, the droplets move closer and closer together, forming larger droplets. Eventually these droplets fall to the ground as rain, sleet, or snow, and the water cycle begins again. No water is removed or added to the system; it is simply moved around from place to place!

Water for human consumption comes from a variety of places including rivers, streams, lakes, and underground water sources. Underground sources account for almost half of the water used in the United States. This underground water (also called groundwater) moves around between layers of rock underneath the earth's surface. It takes hundreds of years for water to accumulate underground (thousands of years for the deeper groundwater sources). As human consumption drains groundwater sources, streams, ponds, and marshes dry up. The remaining water is also more vulnerable to contamination from pollution or saltwater. This is one of the reasons why water conservation is so critical in America. If we all worked to save a small amount of water, it would add up to a vast amount overall.

Suggested Procedure:

1. Discuss the water cycle with the students. Make a diagram on the blackboard showing how the sun heats water causing evaporation, then water vapor condenses forming clouds, and eventually clouds release their waters in the form of precipitation. Water may exist in liquid, gaseous (water vapor), or solid (ice) form. The majority of the world's fresh water is frozen in the polar ice caps! The rest of the fresh water can be found in ponds, lakes, streams, rivers, and underground.

2. Discuss with the students why water conservation is important. The water that is taken from groundwater sources is necessary for other ecosystems to survive. Even though there are many sources of fresh water, such as rivers, lakes, and streams, saving water saves energy. It takes energy to purify water, to heat it, and to move it from place to place. Every person can help conserve water -- it's easy. Have the students make a list of three things they can do to save water. Some suggestions are: don't let the water run when brushing your teeth; don't let the water run to get hot, but try using it a bit colder; don't let the water run to get colder, but keep a water bottle in the refrigerator; don't over-water the lawn; don't use water to wash the driveway or walkway, but use a broom instead; shut off the water in the shower when soaping up, and then turn it back on to rinse. Have the students keep track of the different ways in which they saved water at home or in school. They can write down any savings, even if they weren't previously listed. At the end of a week, discuss the lists with the class. Did the students find any new ways to save water?

   A chart could be made to show how much water the class saved as a whole. Amounts of water could be estimated by testing a faucet, a hose, and a shower to see how long they take to fill a gallon jug. Then ask the class to time how many minutes they <u>didn't</u> use the water when shutting off faucets, hoses, and showers. At the end of a week, have the students bring in their lists and combine them on the class chart. Multiplying the number of minutes water wasn't used by the gallons per minute estimate (for each method of using water) will give an approximate amount of water saved. The class will probably be very surprised at the amount of water they saved.

   Explain to the class that saving water is a positive way that every person can contribute to the conservation of our resources. Every little bit saved by each person can add up to a lot of water -- and energy -- conserved.

GLOBAL WARMING

Subject: Science
Duration: 1 hour
Location: Classroom
Related Activities: Weather Changes

Objectives:

To teach students about the theory of global warming.

Materials:

* Washbasin
* Water
* Large block of ice
* Plastic container

Method:

Discuss with students what "global warming" means, and what some scientists theorize is happening. An experiment will be done to illustrate what might happen if the temperature of the earth's atmosphere increased.

Background:

The planet earth is surrounded by different layers of atmospheric gases that provide protection and life support for its inhabitants. These layers contain oxygen and other gases necessary for life, offer protection from ultra-violet rays, and prevent the escape of heat from the earth's surface. The atmosphere is very important to all life-forms. The earth's surface is heated when the light of the sun shines through the atmosphere. Once the earth is warmed, heat radiates outward and increases the temperature of the air. The atmosphere acts as a buffer to insulate this heat. This is how our planet maintains temperatures that can support plant and animal life. Some scientists theorize that our insulated air may be increasing in temperature due to pollution, especially from carbon dioxide emissions. Since the heated air remains trapped in the earth's lower atmosphere, it may cause the overall temperature of the planet to rise. This is the theory of global warming. If this happens, it would have a dramatic effect in the arctic regions. The increased air temperature would cause the polar ice caps to melt, which in turn would cause a rise in sea level. In coastal areas, flooding would result all over the world. The sea level has been rising since the last ice age, so some increase is normal. Scientists theorize that too much pollution is escalating the ability of the air to retain heat and may be causing global warming.

Suggested Procedure:

1. Discuss the theory of "global warming" with the students. On the blackboard, draw a picture of the earth and its protective layers of gases in the atmosphere. Explain that the earth is surrounded by atmosphere which insulates it to keep our planet warm and full of air to breathe Discuss how the sun heats the earth's surface, and how the heat then radiates into the air. This warm air is contained in the lower atmosphere. This situation can work to our disadvantage if too much heat is generated on the earth. Air pollution may cause a rise in air temperature because of excess gases (especially carbon dioxide) and particulate matter in the atmosphere. Many people are concerned about the possibility of global warming and want to work to help prevent it. Factories, manufacturing plants, and other producers of pollution are being called upon to filter their outputs and decrease the amount of gases and particulate matter being released into the air. Automobile manufacturers are working to develop cars that get better mileage in order to reduce the amount of carbon dioxide expelled. And individuals can help too -- using public transportation whenever possible, combining multiple car trips into one, car pooling, riding bicycles, and walking. These savings all reduce the amount of carbon dioxide emissions. Remember, every little bit helps!

2. The following experiment demonstrates of the theory of global warming. Explain to the students that if the temperature of the earth's atmosphere were to increase too much, the polar ice caps in the arctic would melt. Place a large block of ice in a wash basin filled with water. Tell the students that the block of ice represents an ice cap and the water represents the arctic ocean. The temperature of the classroom will represent the increase that may be caused according to the global warming theory (it will certainly be warmer than the arctic). Mark the current level of the water at the start of the experiment. Take a reading of the rising water level every hour until the ice has completely melted. Discuss the results with the class. What happened to the sea level? If the sea level rises, what happens to coast areas? Tell the students that scientists are working on ways to reduce air pollution so that their theories on global warming do not become realities.

WEATHER CHANGES

Subject: Science, Weather
Duration: 1 hour, plus some time daily
Location: Classroom and Outdoors
Related Activities: In Appendix A

Objectives:

To teach students about weather: weather terminology, different types of winds, and measurement methods.

Materials:

* Paper
* Pencils
* Thermometer

Method:

Discuss different types of weather. Explain weather terminology and measurement tools. Students will set up a weather station and monitor the weather changes.

Background:

Weather -- the only accurate prediction that can be made about it is that it will change. Weather really means "what's going on with the air." It may be hot, humid, sunny, cool, windy, rainy, snowing, sleeting, hailing, or a combination thereof. People have been trying to predict the weather for centuries, but today forecasting is still not foolproof. At times we end up baffled by how the weather changes so quickly.

Pressure systems may sound complicated, but actually they are just hot and cold air rising and falling in a circular fashion. Warm air rises, so it creates a low pressure system (less pressure is exerted toward the earth). Cold air sinks, which causes a high pressure system (more pressure is exerted on the earth). The sun is the instigator of the wind patterns all over the earth. The sun's rays shine down and they are absorbed and converted into solar heat. Land areas that heat quickly will increase the air temperature above them. This warm air above the land rises and creates a low pressure system. When the warm air rises high in the atmosphere, it cools and sinks toward the earth, now creating a high pressure system. Large bodies of water, such as oceans, heat slowly. If the air above an ocean is cooler than the air over land, this cool air will form a high pressure system. Winds are created when cool air in the high pressure systems seek out low pressure areas (where the air is warmer). When the land is warmer than the ocean, winds blow from the ocean to the land. This is called a sea breeze. When the sun sets, the land cools quickly, while the ocean temperature remains fairly constant. At this point the air over the water is warmer than the air over the land, and the winds will blow out toward the water. This is called a land breeze. When the conditions of pressure, temperature, and winds are just right, storms may develop.

Suggested Procedure:

1. Discuss weather terms with the students. Define high pressure system, low pressure system, sea breeze, land breeze, solar heating, and water cycle (see the lesson "What Goes Up, Must Come Down"). Explain that winds are formed by high pressure systems seeking equilibrium with low pressure systems. Tell the students that weather is created by the differential heating of the earth by the sun.

2. Discuss weather indicators with the students. Talk about measuring devices such as thermometers, barometers (measures air pressure), hygrometers (measures humidity), anemometers (measures the speed of wind), and wind vanes or wind socks (measures the direction of the wind). Explain that a meteorologist studies the weather and tries to predict what will happen in the future based on current conditions. Winds which are constantly moving between high and low pressure systems are the delivery systems for our weather.

3. Have the students build a weather station. Include a thermometer, a barometer, a hygrometer, a wind vane, and a precipitation gauge. (Instructions to make these devices are given in Appendix A). Have the students create a weather chart and record their measurements daily for a month. Make headings on the chart for temperature, barometric pressure, humidity, wind direction, wind speed, amount of precipitation, weather conditions, date, and time. Wind speed can be estimated as follows: calm (no wind can be felt), light breeze (can feel wind on face), moderate breeze (objects blown through air), strong wind (trees swaying, difficult to walk). If a storm arises during the day, chart the measurements before and after the storm, if possible. At the end of the month, have the students graph their results (certain measurements can be chosen) and discuss any trends. Were changes noted in barometric pressure or wind before or after a storm? Does temperature rise or fall during a storm? How much precipitation occurred in a month? Are humidity and temperature related in any way? Discuss these and any other influencing factors that may be used to predict the weather. As a continuation of the lesson, students could try to predict the weather based on the information they have learned.

THE NATIVE AMERICANS

Subject: Social Studies
Duration: 1 hour
Location: Classroom and Outdoors
Related Activities: Early European Explorers

Objectives:

To teach students about the Native Americans that lived on the Gulf Coast.

Materials:

* Clay
* Rawhide
* Miscellaneous natural objects

Method:

Discuss Gulf Coast prehistory with the students. Explain how Native Americans lived and survived until the Europeans claimed their lands. As an activity, students will find an object that can be made into a tool and write a short paragraph about it.

Background:

Along the Gulf Coast many different Indian tribes thrived before Europeans "discovered" America. In the Florida panhandle, there were the Apalachicola, the Chatot, and the Panzacola tribes. Along the Mississippi coast, there were the Acolapissa, the Bayogoula, the Biloxi, the Choctaw, and the Pascagoula. These tribes had evolved over many generations of changing traditions that began over 10,000 years ago. The first Native Americans were wandering hunters of the Ice Age. Toward the end of the Ice Age, large mammals such as mammoths and mastodons died out, and cool-climate plants and animals moved further north. They were replaced by other species that lived in warmer climates. Simple tools such as spears, spear throwers (used to help launch spears), mortars, and pestles (used for grinding) were developed by the Native Americans living in this early period. As centuries passed, more tools were developed, including axes, cutting tools, bows, and arrows. Ovens were created, and pottery was made. Eventually, personal ornamentation was desired, and beads, gorgets, and pendants were developed. The food habits of the tribes were modified as the conditions of the environment changed. Hunting always played a large part, but gathering became more and more important. Food collection was seasonal; plants and animals were taken at the time of their greatest abundance. Typical plant items gathered were nuts, berries, tubers, roots, and fruits. Animals hunted were deer, bear, fish, and shellfish. Eventually agriculture began, and corn, beans, and squash were cultivated. Towns and ceremonial centers slowly sprang up, and government developed. Local town leaders would gather together and confer with a high priest or chief in a surrounding major town about important matters. Fortification of the larger towns was common. Ceremonial displays became more important, and burial mounds (for burying the dead) and temple

Background (Con't):

mounds (on which ceremonial buildings were built) were constructed. Personal decoration continued to develop, including tattooing, face painting, ear spools and plugs, and colored feathers and copper decorations for clothing and headdresses. Trade was established with other cultures for items needed and desired. Once the Europeans landed in America, many of these methods and traditions became lost as tribes joined together for survival. Many Native Americans succumbed to diseases brought into the country by Europeans. Wars broke out and many Native Americans were sold as slaves. Those who survived were eventually forced off their land to reservations in more northerly states such as Oklahoma. Today, Native Americans are trying to rediscover traditions and reclaim space on lands that were previously lost. Archaeologists are able to piece together details of Native American heritage that provide valuable insights into the cultures that once flourished along the Gulf Coast.

Suggested Procedure:

1. Discuss with the students the ways in which the Native Americans acquired food. Explain what gathering means. Ask the students to name some plant foods that might have been gathered by the Indians. Berries, fruits, nuts, mushrooms, and roots are possible answers. Discuss cultivation with the students. Ask them to name plants that might have been grown by Indians. Corn, beans, and squash are possible answers.

   Along the Gulf Coast, shellfish (especially oysters) were consumed in large quantities. Shells were used as utensils and tools, and they were also crushed to provide additives to clay for making pottery. Excess shells were dumped in large heaps called middens. Today, many Native American sites are marked by middens that still exist. These shell mounds are protected by National Parks and other organizations so that people can study and observe these ancient landmarks.

2. Ask the students to name objects that Native Americans might have used as tools or utensils. The Indians found that bones from animals made excellent tools and utensils. Bowls, and other vessels, were made from clay. Stone was turned into arrowheads and knives. Oyster shells were used for scraping and wood or rocks for pounding.

   Have the students make a tool or utensil out of natural materials. Materials could be found around the students' homes, in the school-yard, or in other natural environments. Clay could be provided to make bowls or pots. Rocks, stones, and shells could be used to create utensils and tools. Handles could be made from wood. Rawhide (purchased) could be used to tie objects onto handles.

Suggested Procedure (Con't):

Have the students write short paragraphs about their tools -- what they are and how they would use them.

Ask the students think about how the Native Americans lived. There is a lot of wisdom to be learned from the simple way in which the Indians inhabited the same landscape that we inhabit today. We all want to protect our environment and preserve it for future generations. Tell the students to think about this wherever they go. Tread lightly on the earth, and when visiting natural areas, don't leave anything behind except footprints.

EARLY EUROPEAN EXPLORERS

Subject: History, Geography
Duration: 1 hour
Location: Classroom
Related Activities: The Gulf Coast Today

Objectives:

To teach students about the early exploration of the Gulf Coast.

Materials:

* Copies of the "Where in the World?" worksheets
* Colored pencils or crayons
* Blank sheet of paper

Method:

Discuss with students the events of early exploration in Florida and Mississippi. Students will identify on a map of the world where early explorers came from, and what they discovered.

Background:

The history of European settlement in the Americas begins back in 1492 when Christopher Columbus landed in the West Indies. He knew he was on to something big and quickly reported his findings to Spain. Many other explorers were to follow. Juan Ponce de Leon, a Spanish explorer who was currently governing Puerto Rico, traveled to Florida in 1513 in search of the "fountain of youth." He landed on what is now Melbourne Beach. Ponce de Leon named the land "La Florida," meaning "the flowery land." Many expeditions both French and Spanish made attempts to establish settlements in La Florida. In 1539 Hernando de Soto, a Spanish conquistador, sailed from Cuba to Tampa Bay. From there he proceeded overland to Georgia, the Carolinas, Tennessee, and through Alabama, Mississippi, and Arkansas. De Soto discovered the Mississippi River in 1541. In 1542 he was killed along its shore and buried in the river.

In 1565, the first permanent European settlement was established in La Florida by a Spaniard, Pedro Menendez de Avriles. He named his city St. Augustine. During the next century, missions were set up throughout La Florida in order to convert Native Americans to Christianity. Times were difficult for many of the settlers; crops did not grow well, livestock was stolen, and subsidies were required from Mexico to insure their survival. With most of La Florida settled by Spaniards, France was eager to obtain land to the west. In 1673 Jacques Marquette and Louis Joliet led a French expedition from Canada down the Mississippi River. The intent of the trip was to determine where the river emptied. Upon reaching the mouth of the Arkansas River, Marquette and Joliet surmised that the river must flow into the Gulf, not the Atlantic or Pacific. They returned to Canada and informed their king, Louis XIV, of their discovery. Robert Cavelier de La Salle was sent to New France (Canada) to

Background (Con't):

continue where Marquette and Joliet left off. La Salle sailed down the Mississippi River all the way to the Gulf of Mexico in 1682. He claimed all the land drained by the Mississippi River for France. Realizing that it is one thing to claim land, and another to hold it, King Louis XIV sent an expedition to colonize "Louisiana." The expedition was led by two brothers, Pierre LeMoyne d'Iberville and Jean-Baptiste LeMoyne de Bienville. They first landed at Ship Island and then settled on the mainland, beginning a town that is today called Ocean Springs. This community was established in 1699. During that time, Admiral Andres de Arriola of Spain settled Pensacola in 1698. Settlement in Pensacola had been attempted once before in 1559, but was abandoned due to hurricanes, disease, and hostile natives.

Many changes took place after settlement began. In 1719 the French attacked Pensacola and claimed it as their own. The Spaniards took it back in 1722. Pensacola continued to change hands many times between France and Spain. At the end of a war between France and Britain, Pensacola was transferred to Britain as part of the West Florida Territory in 1763, and was made the colonial capital. Part of Louisiana (including current day Mississippi and Alabama) was also ceded to Britain as part of West Florida. The British ruled for almost twenty years until Spain invaded Pensacola in 1781. In 1783, Spain was officially given the East and West Florida Territories in the Treaty of Paris.

In 1798, Spain ceded the land south of Tennessee, between the Mississippi and Chattahoochee Rivers, not including coastal land or any part of Florida (as we know it today) to the United States. This land was called the Territory of Mississippi. In 1810, the Spaniards were driven out of Mississippi, and the local people declared the land the Republic of West Florida. In 1811 formal application was made for admission into the United States. By the spring of 1812 the Mississippi coast was officially annexed to the rest of the territory. In 1817 the Alabama Territory was created and Mississippi became a state.

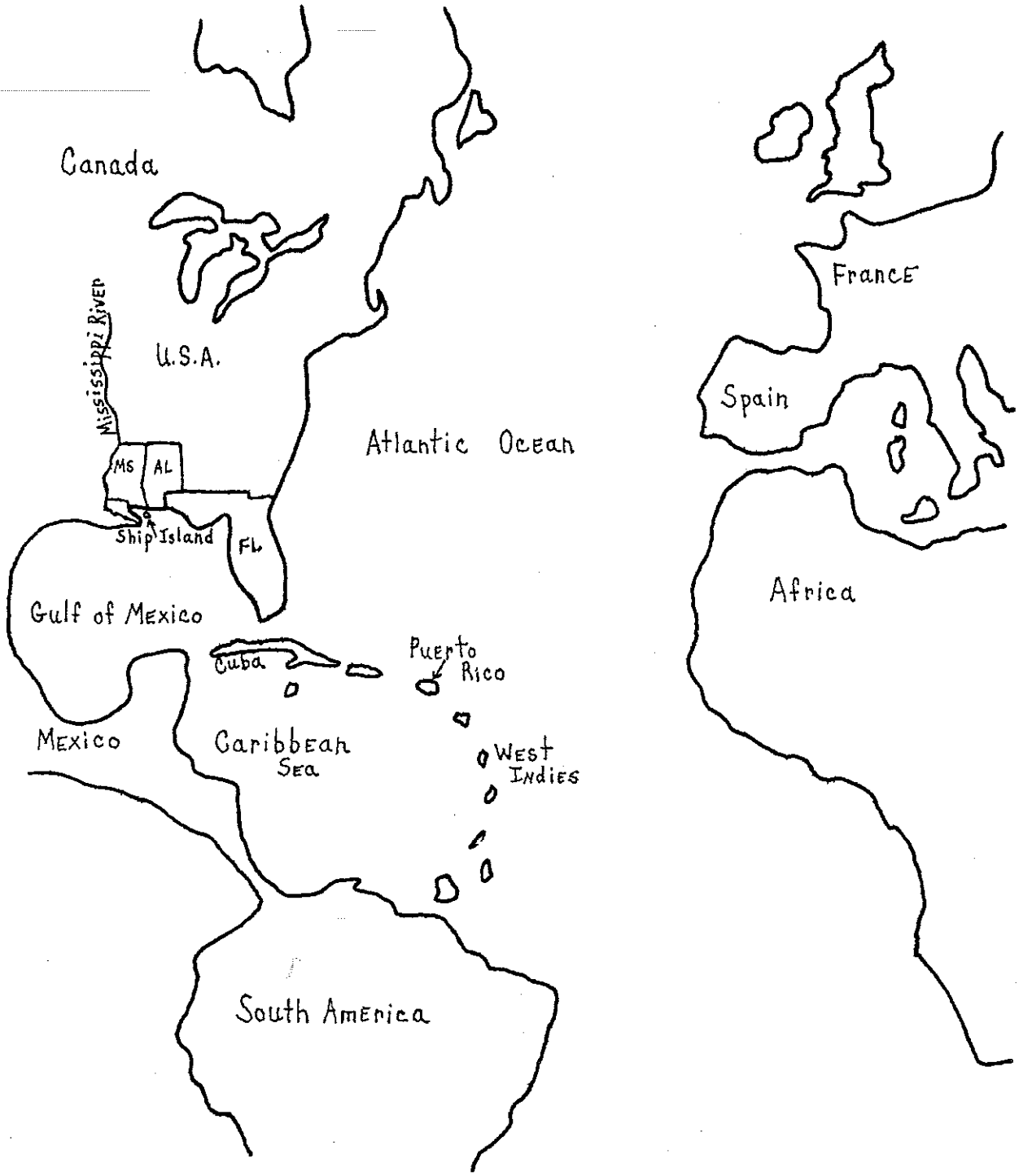
In 1821, Andrew Jackson demanded the surrender of Spanish forts in Florida to the United States, and Florida became a territory. In 1845 Florida got its statehood. In 1861, both Florida and Mississippi seceded from the Union and joined the Confederate States. When the fighting ended in 1865, Union forces had taken over both Florida and Mississippi. Florida rejoined the United States in 1868, and Mississippi followed in 1870. Today, cities, towns, and streets echo the names of the early Europeans that explored the Gulf Coast.

Suggested Procedure:

1. Discuss Mississippi and Florida history with the students. Explain how the Gulf Coast was influenced by European explorers. The French and Spanish heritage of these states is still alive today.

2. Have the students mark the starting and ending locations of the European explorers on the "Where in the World?" worksheet. Each explorer is listed by year, country, and discovery. Once the worksheets are completed, discuss the maps with the class.

WHERE IN THE WORLD?



WHERE IN THE WORLD?

On the map make a different colored dot for each of the explorers listed below in the country or state where they began their trips. On a separate sheet of paper, list the explorers' names and the colors chosen to represent them.

Then using the original color chosen for each explorer, make a dot in the country or state the explorer discovered or settled.

EXAMPLE: Using blue for "Columbus" there would be one blue dot in Spain, where he started his journey, and one blue dot in the West Indies, which he discovered. On the other sheet of paper "Columbus = blue" would be written.

EARLY EUROPEAN EXPLORERS

Explorer	Departed From	Discovery/Settlement	Year
Columbus	Spain	West Indies	1492
Ponce de Leon	Puerto Rico	Florida (Melbourne)	1513
De Soto	Cuba	Florida (Tampa Bay)	1539
De Soto	Alabama	Mississippi River in Mississippi (near Tunica)	1541
Menendez	Spain	Florida (St. Augustine)	1565
Marquette & Joliet	Canada	Mississippi River in Mississippi (near Rosedale)	1673
La Salle	France	Mississippi River at Gulf of Mexico	1682
De Arriola	Spain	Florida (Pensacola)	1698
D'Iberville & Bienville	France	Ship Island (and Ocean Springs, Mississippi)	1699

THE CHANGING OF THE FLAGS

Subject: History, Social Studies
Duration: 45 minutes
Location: Classroom
Related Activities: Early European Explorers

Objectives:

To teach students about the various flags that have flown over Mississippi and the Florida panhandle.

Materials:

* Copies of flag worksheets
* Crayons or colored pencils

Method:

Discuss the history of Mississippi and of northwestern Florida. Explain that different countries ruled these areas at various times. Students will color in flags that were flown over Florida and Mississippi.

Background:

Both Mississippi and Florida have had a colorful past. They have each been colonies of Spain, Britain, and France. During colonial times, the flags that flew over Florida and Mississippi changed frequently. Today, the stars and stripes are their colors, but it wasn't always so. Florida was first claimed by Spain, then France, then Spain again, then Britain, then Spain again, then the United States, then the Confederate States, and finally the United States. Mississippi was initially claimed by France, then Britain, then Spain, then the United States, then the Confederate States, and finally the United States. Both Florida and Mississippi also had territorial flags and state flags. Mississippi additionally flew the flag of the West Florida Republic for a short time. All these changes add up to a lot of history. More details on specific dates and actions are included in the "Early European Explorers" unit. The remnants of these cultural changes are evident today in place names and in social contributions.

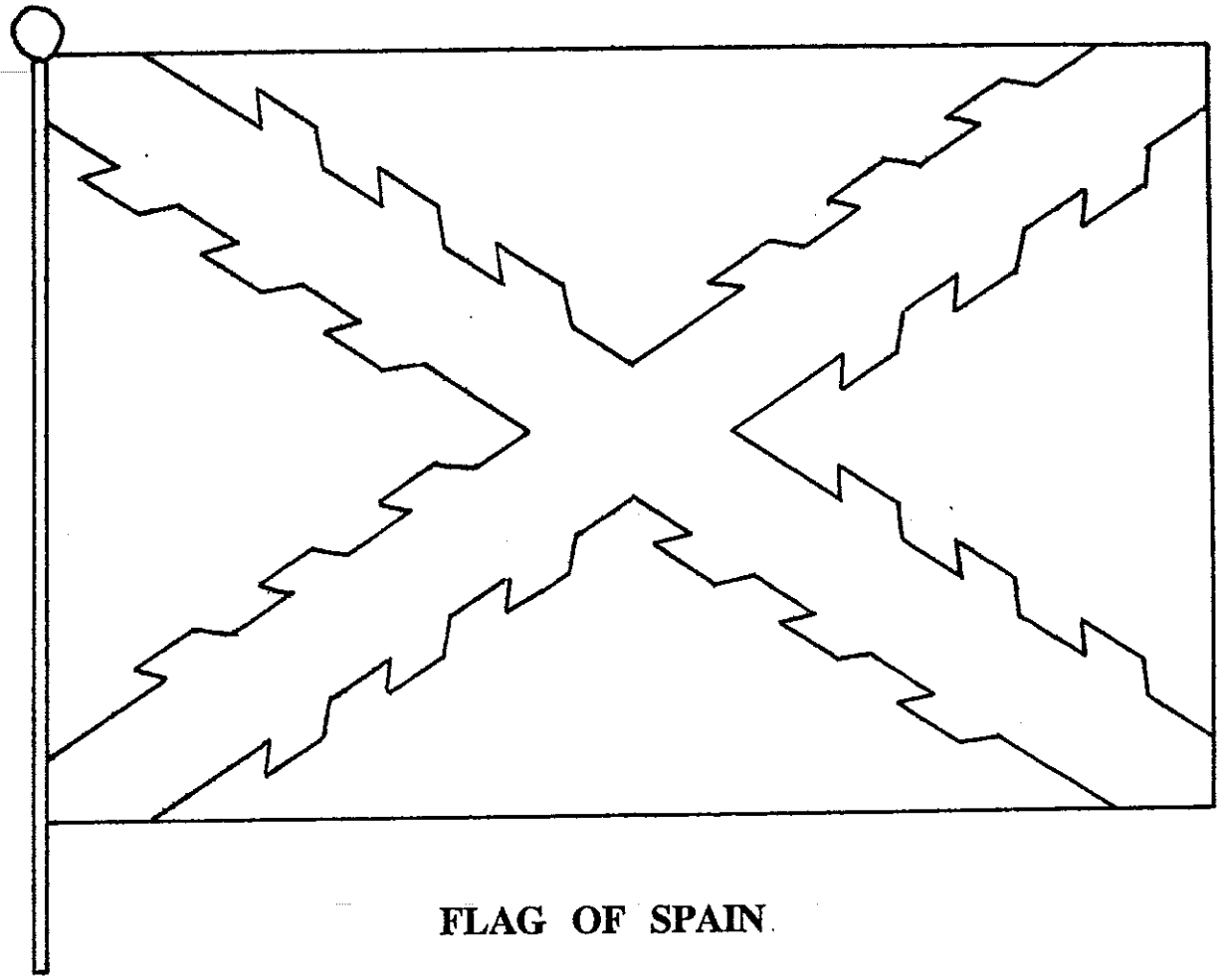
Suggested Procedure:

1. Discuss the history of Florida and Mississippi with the students. Explain that these lands were bounced back and forth between countries battling for them. Florida was mostly governed by the Spanish, while Mississippi was ruled for the longest time by the French. Today, Mississippi has been a part of the United States for 176 years, for longer than it had been governed by any European power. (France's rule was the next longest at sixty-four years.)

Suggested Procedure (Con't):

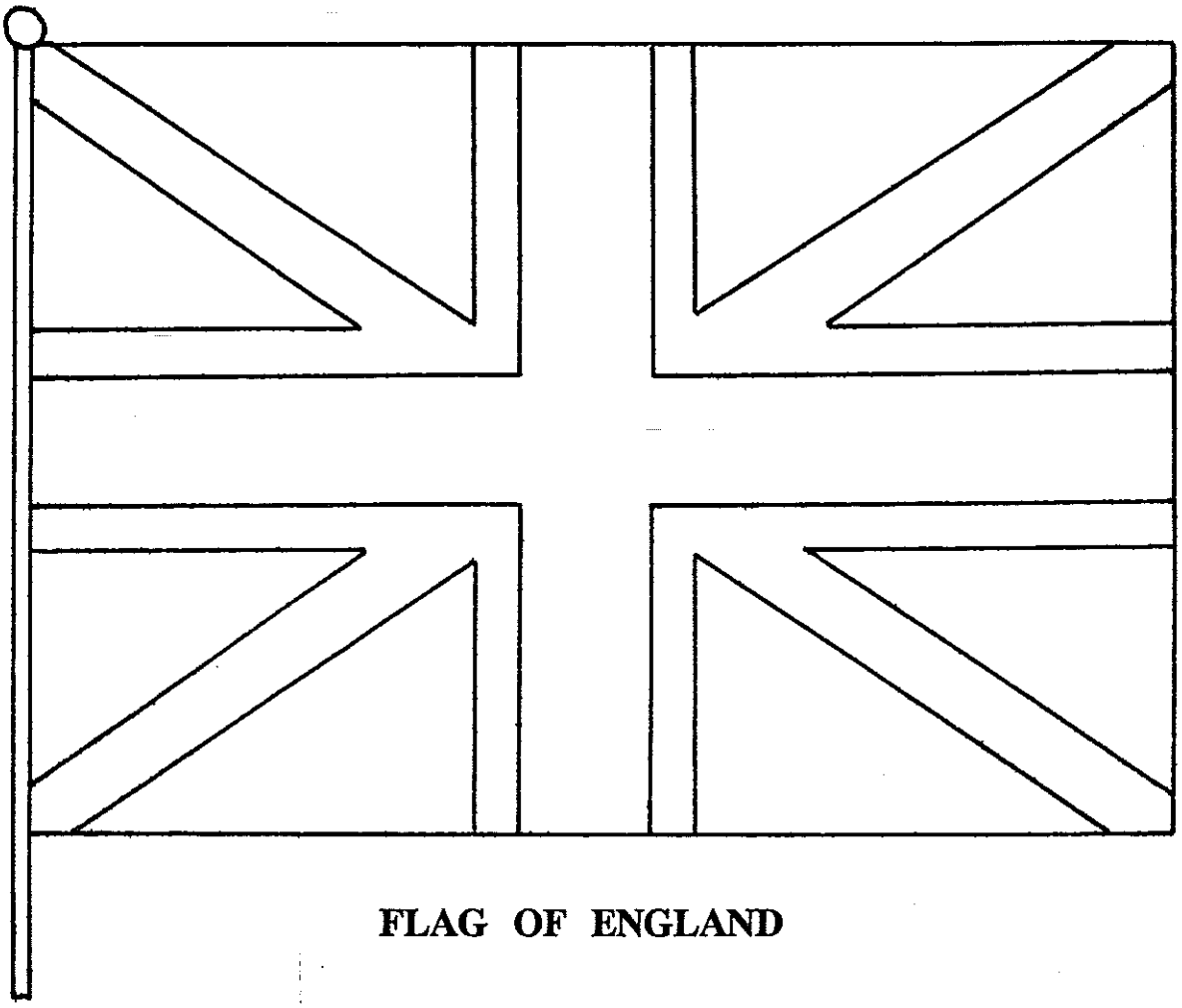
Florida, on the other hand, a part of the United States for 148 years, needs many years to catch up with the amount of time that Spain ruled it -- over 240 years!

2. Have the students color the flags representing the different countries that claimed Mississippi and Florida. Tell the students that there were other flags in addition to these, including state flags, territory flags, confederate flags, and republic flags.



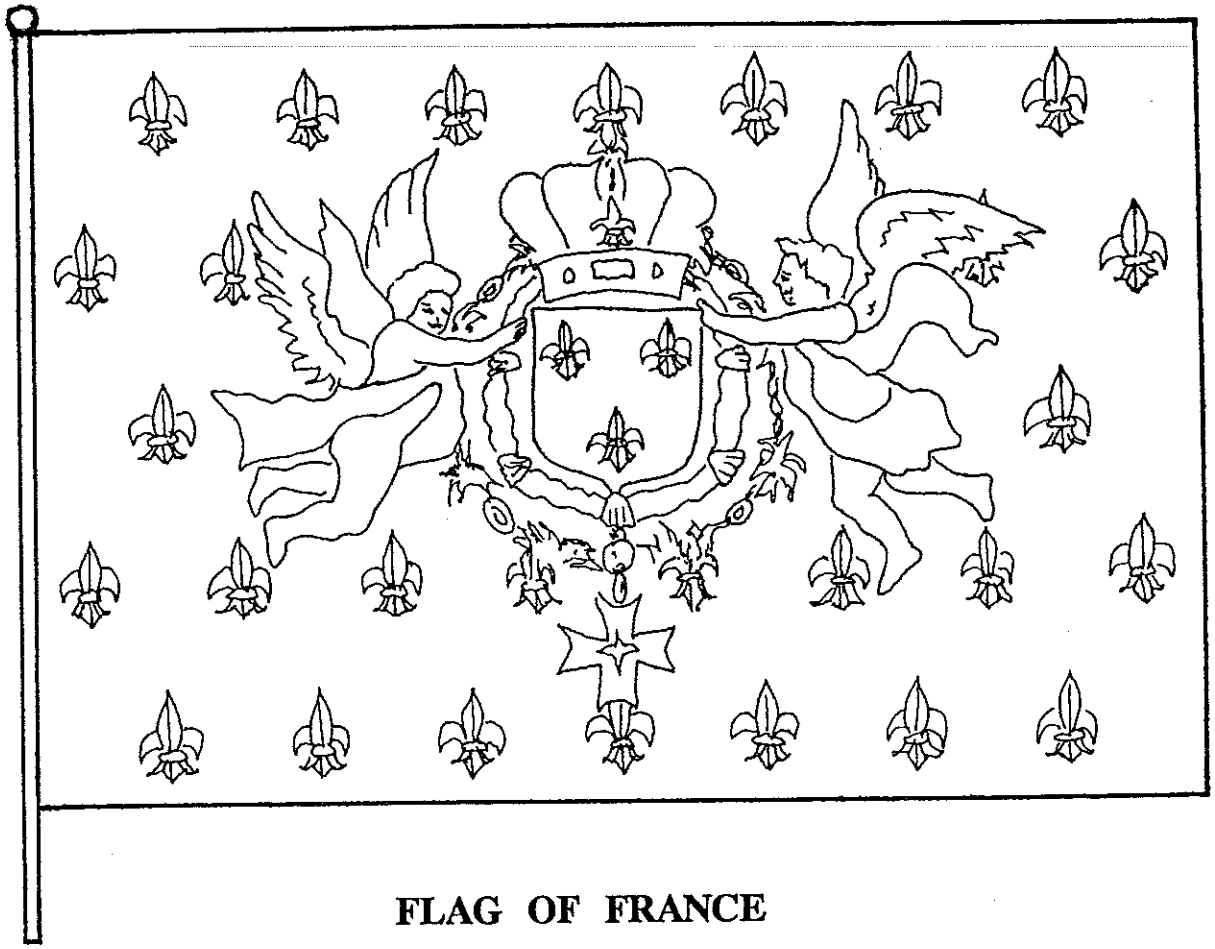
FLAG OF SPAIN

COLORS:	THE CROSS BARS ARE	-	RED
	THE BACKGROUND IS	-	WHITE



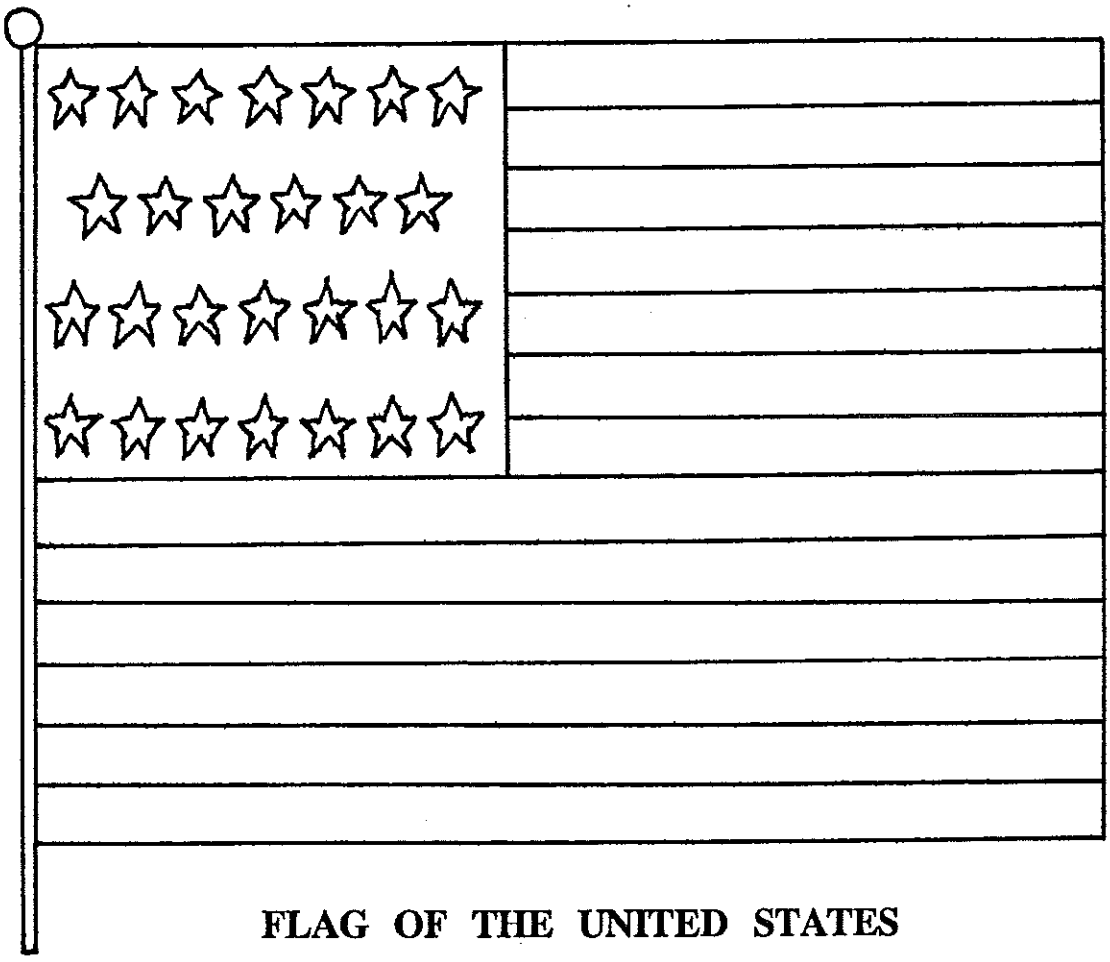
FLAG OF ENGLAND

COLORS:	THE CROSS BARS ARE	-	RED
	THE TRIANGLES ARE	-	BLUE
	THE BACKGROUND IS	-	WHITE



FLAG OF FRANCE

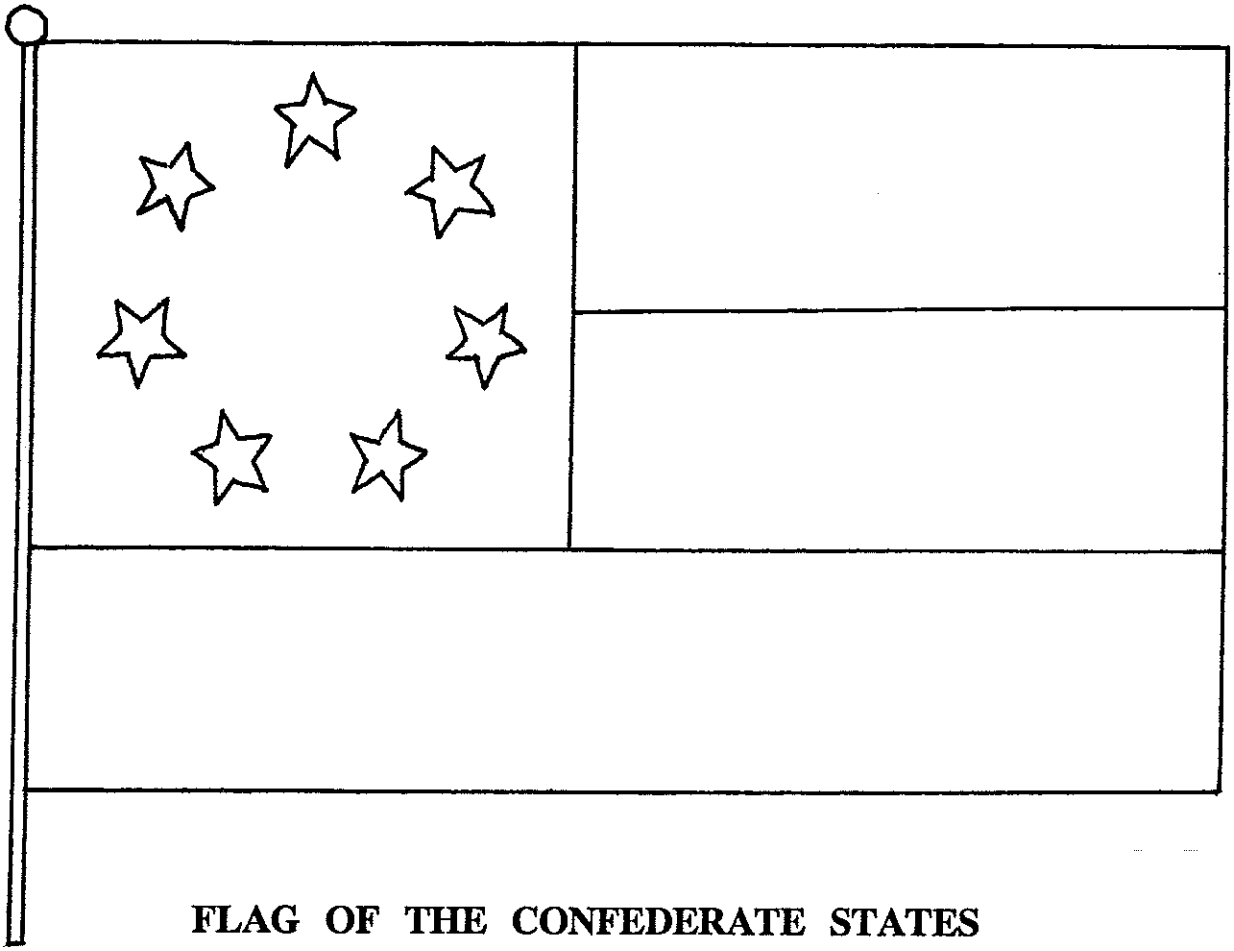
COLORS:	THE BACKGROUND SYMBOLS ARE	-	YELLOW
	THE CROWN IS	-	RED
	THE SHIELD IS	-	BLUE
	THE CROSS IS	-	BLACK
	THE ROPES ARE	-	YELLOW
	THE ANGELS' WINGS ARE	-	GREY
	THE ANGELS' HAIR IS	-	YELLOW
	THE ANGELS' SCARVES ARE	-	PURPLE
	THE BACKGROUND IS	-	WHITE



FLAG OF THE UNITED STATES

COLORS:	**THE STARS ARE**	**-**	**WHITE**
	THE SQUARE IS	**-**	**BLUE**
	SEVEN STRIPES ARE	**-**	**RED**
	SIX STRIPES	**-**	**WHITE**

THE CHANGING OF THE FLAGS



FLAG OF THE CONFEDERATE STATES

COLORS:	**THE STARS ARE**	**-**	**WHITE**
	THE SQUARE IS	**-**	**BLUE**
	TWO STRIPES ARE	**-**	**RED**
	ONE STRIPE IS	**-**	**WHITE**

HOW TO BUILD A FORT

Subject: History
Duration: 1 hour
Location: Classroom
Related Activities: Lighting the Way to a New Era

Objectives:

To teach students how and why some of the forts along the Gulf were built.

Method:

Discuss with the students the materials used in fort building. Discuss the conditions the men endured during construction. The class will make hard tack, a common food staple of the workers.

Materials:

* Flour
* Water
* Salt
* Rolling pin
* Waxed paper
* Knife and fork
* Measuring cup
* Teaspoon
* Use of an oven

Background:

Along the Gulf Coast a third system of coastal defense was developed to protect shipping channels, naval stations, and important mainland areas. Gulf Islands National Seashore currently maintains four of these forts, and also many batteries as well. The forts were built of earth, bricks, mortar, and concrete. Millions of bricks were used for these forts. Fort Pickens in Florida may include in its structure as many as twenty-one million bricks! Bricks are made by forming clay in molds and then heating them in an oven. Clay is obtained from lake and river bottoms. Many of the bricks were laid as is, but some of them had to be cut and sculpted. Arches can be seen in the forts; they were used to increase the strength of the structures. In these curved areas, bricks had to be cut on different angles in order to fit properly. In the construction of Fort Massachusetts, located on Ship Island in the Mississippi Sound, bricks were originally obtained from Louisiana. After the Civil War broke out and Union forces occupied Ship Island, southern brick could no longer be obtained. To continue construction, brick was shipped all the way from New England. When the Civil War ended, the fort was completed with southern brick. At times, obtaining materials was very difficult. For the builders of these forts, working conditions were poor. The heat, bugs, lack of protection from the sun, storms, diseases, and unclean water made life hard for them; illness and death were common. By the late 19th century, new weapons had made the earth and masonry fortifications obsolete. Concrete and earth batteries were built instead for coastal defense. Eventually, they too became obsolete. Guided missiles and nuclear weapons were developed, and forts were no longer needed.

HOW TO BUILD A FORT

Suggested Procedure:

1. Discuss coastal fortification systems with the students. Explain that forts such as Pickens, Massachussets, Barrancas, and Advanced Redoubt were built for defense, to protect valuable waters and lands from invasion. Brochures on these forts and on batteries and coastal artillery are included in Appendix B.

2. Many workers were required to design and build coastal forts. Architects, contractors, project supervisors, engineers, masons, carpenters, blacksmiths, laborers, bakers, and cooks were all necessary for completion of the forts. Many of these men worked under extreme hardship. The heat, humidity, and bugs were oppressive. Overexposure at times led to skin cancer. Tainted water caused dysentery, which was a leading cause of death. Pneumonia was the second most common cause of death. Other diseases were also contracted, including malaria, and they were at times fatal. Food for the workers was rarely fresh or fancy. A common staple in the diet of workers and soldiers was hard tack, a type of hard baked bread very similar to a large, thick cracker. Tell the students that they will make and eat hard tack to sample a part of the diet of the working men.

Recipe for Hard Tack

Ingredients:
- 3 cups flour
- 1 cup water
- 1 tsp salt

Mix the ingredients together, knead, and roll flat on waxed paper. Cut into approximately 6-8 squares. Each square can be perforated in the shape of an "X" with the tines of a fork. This will make it easier to break into pieces for eating. Bake in an oven for about 1 1/2 - 2 hours at 250 degrees. Ask the school's cafeteria supervisor bake the hard tack in a school oven. If a school oven cannot be used, a toaster oven would be a good substitute. For a class of twenty-five students, four batches would be sufficient. Please note that hard tack is just that -- extremely hard. When the students prepare to eat it, small bites would be advisable. The men frequently dipped their hard tack into coffee to soften it, the students could do this too using hot cocoa instead.

Have the students eat their hard tack and ask them for their opinions about it. Tell them that hard tack isn't an especially rich food, but it was an important part of the workers' diet in an era before refrigeration.

WHAT HAPPENED HERE?

Subject: History
Duration: 1 hour
Location: Classroom and Library
Related Activities: The Native Americans

Objectives:

To teach students about the historic uses of Gulf Islands National Seashore's lands and waters.

Materials:

* Paper
* Pencils

Method:

Discuss with the students the historic uses of Gulf Islands National Seashore before it became a National Park. Students will research and write a story describing their school land and how it was used before it became a school.

Background:

The lands and waters of Gulf Islands National Seashore have experienced many interesting changes throughout history. The coastal lands and islands of Florida and Mississippi were used by Native Americans before Europeans set foot in America. Later, Europeans arrived, and towns and cities were established in and around the areas that are now maintained by the National Park Service.

In the 1700's, the Naval Live Oaks area of the Florida district was established as the first federal tree farm in the United States. It was called Naval Live Oaks because its purpose was to protect and grow live oak trees for naval ship building (live oak wood is extremely strong and resistant to decay). Some of the famous ships built of live oak include the Hancock, an American Revolution-era Privateer, the USS Constitution, and the USS Constellation. When the Constitution was involved in a battle with the British during the War of 1812, it received the nickname "OLD IRONSIDE" because of the incredible strength of its live oak hull. In order to guarantee that there would always be a supply of live oaks for ship building, the United States Government began to cultivate and protect these valuable trees. Today at Naval Live Oaks, many of these magnificent trees can be seen.

Ship Island, located in the Mississippi Sound, has had many uses in its past. Numerous buildings have existed on Ship Island, including Fort Massachusetts (which still stands), a United States military prison, officer's quarters, barracks for troops, a bakery, a commissary storehouse, a carpenter shop, a guardhouse, a lighthouse, a hospital, and a quarantine station. In 1880, Ship Island became the first

Background (Con't):

United States Quarantine Station. All boats coming through the Ship Island channel had to stop at the station. Inspections were done for Yellow Fever, and if the disease was found among the passengers, all were quarantined for a period of twelve days (the incubation period). In 1895 a disinfecting process was used in which vessels were sprayed with mercuric chloride outside and then fumigated with sulfur smoke inside. The Quarantine Station at one time maintained twenty-four structures on the island including a Yellow Fever Hospital, a general Hospital, a blacksmith shop, a boathouse, stables, a crematory, a coalhouse, a gas generating station, an administration building, a surgeon's residence, and others. Most of what remained of the Quarantine Station was destroyed in 1969 when Hurricane Camille passed over the island and cut it in two.

Gulf Islands National Seashore was established to protect some of the cultural, natural, and historic resources found on the lands and islands of the Florida and Mississippi Gulf Coast.

Suggested Procedure:

1. Discuss with the students the history behind Gulf Islands National Seashore. Brochures in Appendix B give additional information. Ask the students if they know of local historic structures in their neighborhoods that still exist today or that existed in the past.

2. Have the students research the history of their school. Using local history books in the library, have them find out as much information as possible about the previous use of the school property. Was it a plantation or a farm? Did it have any historic structures on it? What different cultures lived on the land before, during, and after European settlement? The students can each try to find out information about how the school land was used. Even a little piece of information is valuable. Then have the students share their knowledge with the class. Write up a story as a class about the school land and how it was previously used. Have the students share their story with the rest of the school.

LIGHTING THE WAY TO A NEW ERA

Subject: History
Duration: 1 hour
Location: Classroom and Library
Related Activities: How to Build a Fort

Objectives:

To teach students about lighthouses along the Gulf Coast.

Materials:

* Paper
* Pencils

Method:

Discuss with the students the construction and destruction of local lighthouses. Talk about lighthouses still in existence today. The students will sketch a lighthouse and research the history of a local lighthouse.

Background:

Throughout the centuries, lighthouses have been linked with romance and mystery. They are formidable structures, but they are not free of hardship for the lighthouse itself, or its occupants. During the beginning of the nineteenth century, the United States government began a program to establish lighthouses along the Gulf Coast. Before the Civil War, as many as fifty-nine lighthouses were built. The lighthouses had to contend with many forces of destruction, including tropical storms and hurricanes; but most of the blows struck at lighthouses came during the Civil War. The Union ships fired cannonballs at them, and the Confederate Troops followed suit with additional artillery. The Southern Navy felt that the lighthouses mostly benefited the North, so they began to disemploy them by removing lights and other essential equipment. At the end of the war, the lighthouses were refitted with equipment and put back in the business of guiding ships safely to port.

Along the Gulf Coast, lighthouses hold a lot of history in their towers. Many no longer stand today, but a few can still be seen. Lighthouse towers were constructed from brick, stone, iron, or wood. The light, magnified by a lens called a Fresnel (fre-nel), was lit initially with whale oil, then kerosene, and eventually electricity. Many of the islands in the Gulf of Mexico had lighthouses on them at one time or another.

Both Ship Island and Horn Island had lighthouses on their shores at one time. The initial structure on Ship Island was brick, but it was declared unsafe due to water underneath its foundation. The lighthouse keeper had requested a new light due to the fact that the light wouldn't stay lit during stormy weather. He explained that the lighthouse itself would swing back and forth which caused the

Background (Con't):

light to constantly blow out! A wooden structure was erected to replace it in 1886. During the 1930's a lighthouse keeper and his family moved into the lighthouse on Ship Island. They lived on the island for many years and considered life there paradise. The wooden lighthouse survived Hurricane Camille but accidentally burned in 1972. Horn Island's first lighthouse was the victim of eroding sand and was moved to another location on the island. Eventually, the structure was rendered useless due to the shifting of sand and was abandoned. Another lighthouse was quickly built, but it was destroyed by a hurricane. The hurricane also swept away the lighthouse keeper and his family. A final lighthouse was constructed in 1908, and it remained in use until 1964. It no longer stands today. One of the most famous lighthouses built along the Mississippi coast still shines. It is the Biloxi light and can be seen towering over the median strip of Highway 90 in Biloxi. In its early days after the Civil War, the lighthouse had a close call with destruction. It was found to be tilting over two feet to one side and workers were instructed to clear away soil from underneath the opposing side. In what was considered almost a miraculous recovery, the tower was successfully straightened. The Biloxi lighthouse was the first one to be constructed in the south with a brick and mortar tower sheathed in cast iron. This design has proved a successful one, as the light has endured many Gulf storms, including Hurricane Camille. It was operated by a woman lighthouse keeper for over sixty years. First Maria Youngham tended it, and then her daughter took over after her death.

The Florida coastline has been illuminated by many lighthouses too. In 1824 the United States Navy established a military base in Pensacola. During that year, a lighthouse was built to guide warships in and out of Pensacola harbor. This lighthouse was criticized for not being bright enough, and in 1858 a massive replacement was erected. This new light stood 210 feet tall, and its beacon could be seen up to twenty-one miles at sea. During the Civil War the Confederates removed the lighting apparatus, and it remained hidden until the war ended. This lighthouse has been struck by lightning (in 1875 the lantern was seared and metal parts were fused together), shaken by an earthquake, and has withstood many hurricanes. Today it is still in use. Another lighthouse currently functioning is located on St. George Island, at the western entrance of Apalachicola Bay. Its predecessor, a seventy foot tower, was destroyed when a devastating storm knocked it down. The current tower was rebuilt in 1852, and even though it has been assaulted by storms and Confederate artillery, it remains undaunted. Nearby, at Cape San Blas, another lighthouse blinks in tandem with the St. George light. It too was rebuilt. After only four years of beaconing, the Cape San Blas light was knocked down by the same hurricane that took down the St. George. Five years later it was reconstructed, and a few months later another storm pushed it over. The lighthouse was again rebuilt, just before the Civil War. It was set afire during the war, but the majority of the light remained intact. The next obstacle the Cape San Blas lighthouse had to face was erosion. By 1882 the surf had covered up the lower eight feet with water. Eventually the light began to tilt, and finally it could hold itself up no longer and crashed into the sea. A fourth and final lighthouse was erected in 1885 -- but not without difficulty. The ship carrying

Background (Con't):

the iron tower sank near Tampa Bay. The tower was salvaged and put in place on Cape San Blas only to be moved inland three times before it was finally beyond the threat of encroaching seas. It is still there today.

All in all, lighthouses have endured many hardships, but they remain romantic and mysterious beacons for seafarers and landlubbers alike.

Suggested Procedure:

1. Discuss with the students the construction and destruction of some of the lighthouses along the Gulf Coast. Explain that these lighthouses not only had to contend with hurricanes and shifting sands, but also with artillery fire during the Civil War. Some lighthouses were built, rebuilt, and sometimes even rebuilt again.

2. Lighthouses affect individuals in different ways. They may be seen as romantic, foreboding, strong, spooky, comforting, ominous, reliable, protective, or as a work of art. Have the students draw a lighthouse. The lighthouse could be made of wood, metal, brick, stone, or masonry. It could be placed on an island, on a cape or a point, on a pile of rocks, or any type of shoreline. Have the students write down what it would feel like to live in the lighthouses they have created.

3. Lighthouses are interesting, and some of them have a very colorful past. Have the students choose a lighthouse that is in a local area and find out about its history. Ask the students to research the following: when was the lighthouse built; what materials was it made from; was it the original lighthouse on the site; if it is not the original, how many other lighthouses were erected on that spot; what disasters did (or didn't) the lighthouse survive; who were some of the people who tended the light. If possible, plan a class trip to see how the lighthouse looks today.

THE GULF COAST TODAY

Subject: Social Studies
Duration: 1 hour
Location: Classroom
Related Activities: Early European Explorers

Objectives:

To teach students about the various cultures that are represented along the Gulf Coast.

Materials:

* Students will bring objects from home

Method:

Discuss culture and heritage with the students. Have the students write about family customs that they are proud of. Each student will bring a traditional object for show or a food for taste.

Background:

America is often referred to as a "melting pot" of cultures. This is both accurate and misleading. It is accurate because some people choose to blend into society and become part of the ever-changing, ever-growing melting pot. On the other hand, it is misleading because many people retain their culture and heritage and strive to pass on traditions to their children. This mixture of cultures allows Americans the opportunity to study and observe other peoples' traditions. People are usually very interested in sharing their customs with others. All around the United States, different cultures can be seen and sampled in museums, stores, and restaurants. In certain parts of a town or city, ethnic groups may settle in pockets and these areas are rich with culture and tradition. African, Alaskan, Arabian, Australian, Chinese, English, Egyptian, French, German, Greek, Haitian, Hawaiian, Indian, Irish, Italian, Japanese, Korean, Mexican, Native American, Nordic, Polish, Portuguese, Russian, Scottish, Spanish, Swiss, Turkish, and Vietnamese are just some of the nationalities represented in America. As Americans, we are able to learn about and sample some of these cultures every day.

Suggested Procedure:

1. Discuss heritage with the students. How many different cultures are represented in the class? Take a survey. Ask the students how recently their families came to this country. Was it many generations back, or only a few?

Suggested Procedure:

2. Ask the students if culture and family traditions are important to them. Tell them to write a short story about one family tradition that they are especially proud of. Post the compositions in the room so the students can read each others' stories.

3. Tell the students that there is going to be an "International Day" held in the classroom. Each student will bring something to class that represents his or her heritage or culture. It could be a toy, a historical artifact, clothing, food, or any other traditional object. Each student will talk to the class about whatever item was brought in. Food can be shared by the entire class after the show-and-tell session has ended.

LET'S GO RECYCLING

Subject: Conservation
Duration: 1-2 hours
Location: Classroom and Lunchroom
Related Activities: The Trees Around Us

Objectives:

To set up a recycling center in the school for students and teachers to use.

Materials:

* Large cardboard boxes
* Poster board
* Magic Markers
* Tape

Method:

Students will use boxes as recycling containers. Signs will be made giving instructions and showing box contents. Recycling pickup will be coordinated with parents or a local recycler.

Background:

Recycling is the wave of the future. It is one of the easiest waves to ride; everyone can do it. Aluminum cans, tin cans, bottles, newspapers, and white paper can all be reused -- over and over again. Instead of always taking raw materials to make these products, the old products can be easily converted back into "new" recycled products. This not only reuses materials that would otherwise be taking up landfill (dump) space, but it saves energy and resources too. It takes less energy to turn used paper into recycled paper than it takes to start from scratch with trees. Another large benefit of recycling is that it saves trees. But the greatest reason why America (and other countries as well -- some are even far more advanced than us in recycling) has begun to recycle is that our dumps are filling up at a fantastic rate. Most rubbish that leaves our homes is either burned or buried. Burning, which causes problems because of the pollutants released into the air, is used less frequently than burying. The more "useable" trash we can keep out of the garbage, the less that has to be disposed of in other ways. Many people have begun composting. That means they take all their food scraps (not including meat products) and place them in a heap in a back corner of their yard. There nature takes over. Air, water, and agents of decay (worms, bugs, etc. that move in without formal invitations), complete the decomposition process. Turning the pile regularly helps to speed up decay, but isn't necessary. This compost heap will eventually produce a dirt-like material which can be used for fertilizer. It has been said that if America were to recycle and compost, the amount of garbage left over would only amount to about twenty percent of what it used to be!

Suggested Procedure:

1. To begin setting up a recycling center in the school, first find out what objects the local recycling center recycles. It may be all or some of the following: newspapers, white paper, aluminum cans, tin cans, plastics (usually only from drinking cartons such as milk or soda), and glass.

2. Once it has been decided what can be recycled, the recycling boxes can be set up. One box will be used for each item, and the larger the box, the better. Make a poster to go above each box, specifying the articles to be placed inside. A poster with general rules would be good to have also. Some basic recycling rules are: rinse out cans and bottles with water before putting them into the boxes; remove caps and lids from bottles; don't throw garbage into the recycling boxes; place bottles in carefully so they don't break; don't put in glossy sections from the newspapers; and don't put colored paper into the white paper box. On the sign above each box, write the items to be placed in it in LARGE BRIGHT LETTERS. Then include any additional information on the sign, such as do's and don'ts -- but do not make the sign too cluttered, or nobody will want to read it.

3. Set the boxes up in a highly visible location (but not blocking anything). The lunchroom would be an ideal location. Encourage students and teachers to participate. It would be great if a small recycling demonstration could be given to explain how to use the boxes and what the benefits of recycling are. This way all the students and teachers will feel like they are part of this recycling project.

4. Every other week, or as often as necessary, empty the recycling boxes. If the local recycler will pick up the recyclables at the curbside, that would be ideal. The items could be moved out to the curb and left for removal. An extra set of boxes would be handy at this time, so one could remain at the recycle station, and one could be used to dispose of the recyclables collected. If a local recycle pickup cannot be arranged, have a rotating schedule where each parent helps out perhaps only once during the school year. If everyone chips in, it is only a small amount of work for each student, parent, and teacher.

5. Congratulate everyone for helping. Make a poster and keep track of the number of boxes collected for each type of recyclable. Make sure that everyone knows what a positive contribution they are making to help the environment. Just think what the piles of recyclables would look like if every school in America recycled!

NATURE-CASTS

Subject: Earth Science
Duration: 2 hours
Location: Beach
Related Activities: Who Lives in the Sand?

Objectives:

To make a plaster cast of a natural impression or track in the sand.

Materials:

* Cardboard strips
* Spray starch
* Plaster of Paris
* Water
* Mixing bowl
* Spoon

Method:

During a field trip to the beach, an animal track or other image can be found in the sand, and a casting of it can be made.

Background:

Along sandy shorelines, impressions of previous visitors abound. They may have been made by birds, people, mammals, reptiles, mollusks, or even plants. Tracks can be followed, in and out of the dunes, up and down the beach. Some seem to be mysteriously placed without a beginning or an ending. Impressions are made when a leaf blows across the sand or becomes imbedded in it. These indentations are eventually washed away by tides or blown away by wind. Images made by these plants and animals can be frozen in time by making plaster casts of the patterns that were created.

Suggested Procedure:

1. Molds for the casts can be made ahead of time at school or home. Small strips of cardboard work well, but other types of materials could be used. Basically anything that can hold the plaster intact while it sets would be fine. Using cardboard strips, about 2 1/2 inches wide by 6 inches long, a square can be made by taping the ends together. The result is a small rectangular box with no top or bottom. Circular molds can be made with a large strip of oaktag, cut up soda bottles, or other stiff material.

2. Once at the beach, have the students search for an impression that they would like to cast. Slightly moist sand works best for casting. Once they have found an image, have them mark the area with a stick or other object to identify it. Some students may get creative and put leaves or shells in their area to be cast. This works well too.

Suggested Procedure (Con't):

3. Once the students have located their impressions, the images can be cast one at a time. Help the student put his or her mold around the area to be cast. Push it into the sand carefully, trying not to disturb the grains of sand. Sometimes an image in dry sand will crumble when the mold is placed around it. Tell any student who selects such a dry area that it may crumble, and another image might need to be selected. Spray the area with starch to help hold the sand grains in place. Having each area prepared ahead of time will help to streamline the plastering process.

4. Mix the plaster of Paris according to the directions on the box. Once the plaster is mixed, it is important to move quickly. Fill each mold carefully and evenly to a depth of about 1 inch. The molds will need to remain undisturbed for about forty-five minutes. Once all the molds are filled, have the students go beachcoming while they wait for the plaster to set.

5. Once forty-five minutes have elapsed, the molds can be picked up from the sand and turned over. Keep the molds around the cast until they are taken home. Most of the sand that is attached to the cast will come off as the plaster dries. Some sand will remain imbedded in the mold. Have the students try to identify who or what created their tracks and images.

WILDLIFE UP CLOSE

Subject: Conservation
Duration: 1 hour
Location: Classroom
Related Activities: In the Air -- Birds!, Creature Features

Objectives:

Have a wildlife rehabilitator visit the school to give students a close look at and understanding of local animals.

Materials:

* Paper
* Pencils

Method:

Invite a local wildlife rehabilitator to school for a presentation. The program would include live animals and information about wildlife.

Background:

Wildlife rehabilitators help injured or sick wild animals to mend their injuries or illnesses. Once the animals are cured, they are returned to the wild. Animals may be brought to a rehabilitator that have been shot, hit by a car, or suffered some other type of misfortune. Often these animals can be helped and eventually set free. Unfortunately not all animals brought to a rehabilitator can be released. Sometimes injuries are so extensive that the animal would not be able to survive in the wild. Loss of sight is a common problem, as well as "imprinting." Imprinting is a problem that occurs when a young animal is found and raised by a human being. The animal associates humans as its parents and becomes tame. Such an animal cannot usually survive in the wild, mainly because it will always gravitate toward humans for food and security. Animals that can't be released are usually used for educational programs. With beautiful live representatives to see (and sometimes even touch), learning about wild animals is extremely interesting and enjoyable.

Suggested Procedure:

1. Call a wildlife rehabilitator in the area and schedule a visit for the class. Small groups work best, but a class or two could be combined. A fee may be charged for the visit. If there is no fee, please consider making a donation to help the wildlife rehabilitator to care for the animals.

Suggested Procedure (Con't):

Along the Mississippi Coast the local wildlife rehabilitator is:

Wildlife Rehabilitation and Nature Preservation Society
(W.R.A.N.P.S.)
Huckleberry Hill Arboretum
Pass Christian, MS 39571

(601) 452-WILD

W.R.A.N.P.S. operates The Wildlife Rehabilitation Center which is located at the Huckleberry Hill Arboretum in Pass Christian. Visits can be made to the center on a limited basis only. Please call for information.

Along the Florida Coast the local wildlife rehabilitator is:

Wildlife Rescue and Sanctuary
105 North "S" Street
Pensacola, FL 32505

(904) 433-9453

This sanctuary is open to the general public Wednesday through Friday from 10:00 a.m. to 2:00 p.m.

2. After the wildlife rehabilitator's visit, ask the students what animal they liked best. What new information did the class learn about wildlife? Ask the students if they had seen these animals before, or if any were new to them. What did they think of the animals? Have each student write a short paragraph about the information they learned from the wildlife rehabilitator and another about an animal they saw that was especially interesting. The class could even write a thank you note and send it to the wildlife rehabilitator.

MAKE YOUR OWN RECYCLED PAPER

Subject: Conservation
Duration: 1 hour
Location: Classroom
Related Activities: The Trees Around Us

Objectives:

To teach students how to make their own recycled paper.

Method:

The class will make recycled paper following the step-by-step directions given.

Materials:

* Used paper
* Water
* Laundry starch
* Large baking pan
* Mixing bowl
* Egg beater
* Measuring cup
* Piece of window screen
* Newspaper
* Tablespoon
* Rolling pin

Background:

Recycling is a great way to reuse old writing paper and newspapers. But did you ever wonder how it's done? You'll be surprised to find out how easy it is. By following the directions you too can make recycled paper.

Suggested Procedure:

1. Gather up used paper and newspaper to convert into recycled paper. Extra sections of newspaper will be used later, so keep a few handy. Tear up the used paper into small strips, and tear the strips into small squares. The smaller the better. Put these tiny pieces of paper into the mixing bowl.

2. Add one cup of water and one tablespoon of laundry starch to the bowl. Beat the paper to a pulp using the egg beater. If there is not enough moisture, add another cup of water and one tablespoon of starch. Keep adding the combination of water and starch until the mixture is easily blended. It's okay if too much water goes into the mixture because it will be filtered out later. The pulp will become mushy, and eventually it will look like thick soup.

3. Place the piece of window screen in the bottom of the baking pan. The screen must be smaller than the pan and at least as large as a standard piece of paper. Onto the screen pour about a cup of paper mush (pulp). If the screen is very large, add extra pulp if necessary. Spread the pulp evenly over the screen until it is relatively flat.

Suggested Procedure (Con't):

4. Remove the screen from the pan, and allow the extra water to drip into the pan. Place the screen with the pulp inside a section of newspaper. Using a rolling pin (or some other weight), press the water out of the pulp into the surrounding newspaper.

5. Once most of the water has been removed, carefully flip the newspaper section over. Now the pulp will be facing downwards. Open up the newspaper section and carefully remove the screen.

6. Allow the pulp to dry overnight, and the next day if it is completely dry, lift the pulp off the newspaper. Viola! A new piece of paper has been created.

7. If there is enough room in the class, let each student make a piece of recycled paper. They can get fancy if they want and put pieces of colored paper into the paper mush to make designs.

MAKE YOUR OWN ENVELOPES

Subject: Conservation
Duration: 1/2 hour
Location: Classroom
Related Activities: The Trees Around Us

Objectives:

To teach students another way to recycle paper by turning it into envelopes that they can make.

Materials:

* Used paper
* Pencils
* Scissors
* Glue stick

Method:

Have the students save some paper that has been written on one side only. Using the step-by-step directions, the students will make envelopes from the used paper.

Background:

A great way to save paper and have fun doing it is to turn used paper into envelopes. The paper must be clean on one side, and that side will become the outside of the envelope. The edges of the envelope will be sealed with glue, and the flap will be left unsealed until the envelope is used. At that time, the flap can be sealed with tape or glue.

Suggested Procedure:

1. Paper of at least standard size (8 1/2" x 11") is recommended. Have the students place the paper lengthwise in front of them with the side that has writing on it facing up. (The writing itself will be sideways.) The following steps will transform the paper into an envelope:

   - Fold the lower edge of the paper over toward the upper edge, leaving about one inch at the top. The paper now looks like a very long rectangle with a flap.

   - Fold the flap down over the lower part of the rectangle. This will be top of the envelope.

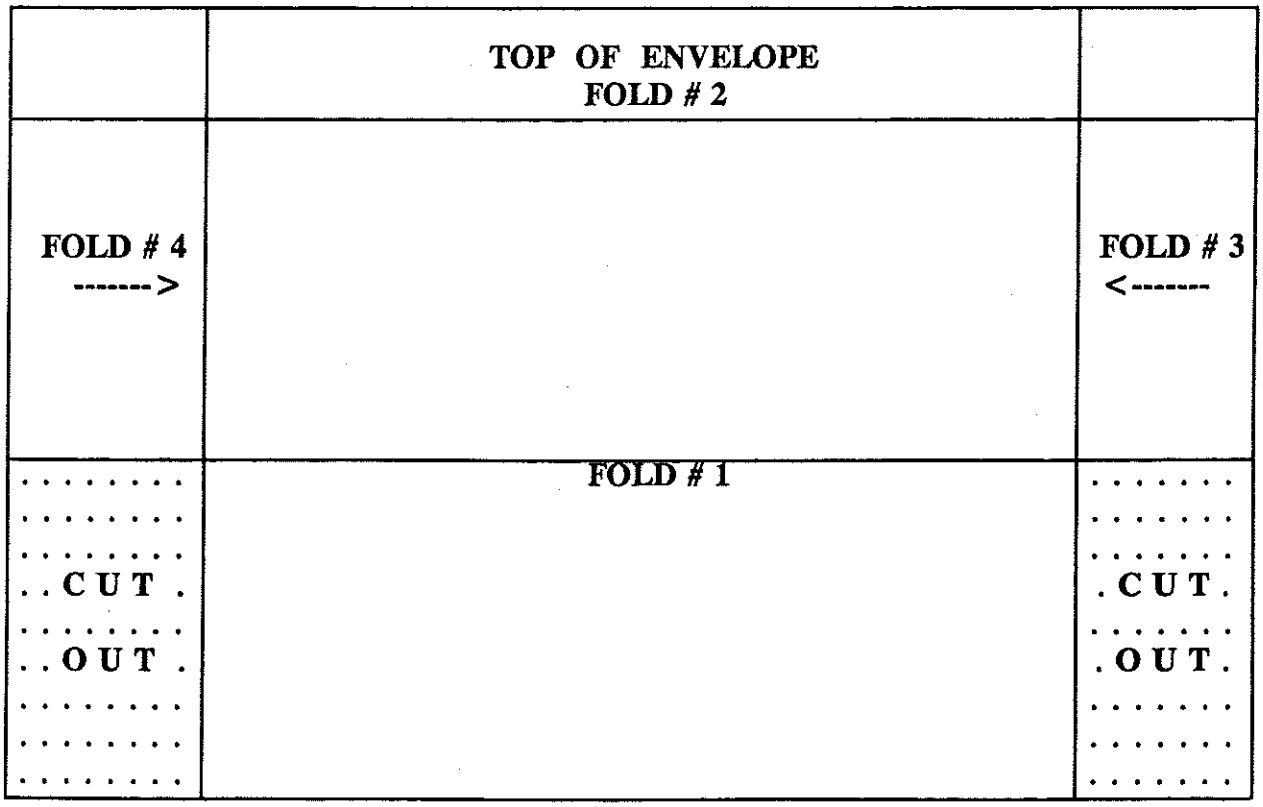
   - Fold the right side of the paper over about one inch and repeat the same step for the left side.

   - Open the paper up, and keep it in the same position.

Suggested Procedure (Con't):

- Note how the creases form long rectangles in the lower left and lower right corners of the paper. Cut out these two rectangles.
- Fold the lower edge of the paper back up toward the upper edge. Now there will be flaps on either side of the envelope, as well as on the top.
- Fold the left flap over the left side of the rectangle. This fold was already creased and will close easily. Fold the right flap over the right side of the rectangle.
- Put glue under each flap and affix them to the sides of the envelope.
- Leave the top flap unsealed until the envelope is ready to be used. When a letter is safely tucked inside, the flap will be folded down over the rectangle and glued or taped shut.

ENVELOPE EXAMPLE



NO MORE JUNK MAIL

Subject: Conservation
Duration: 1/2 hour
Location: Classroom
Related Activities: The Trees Around Us

Objectives:

To reduce the waste of paper by stopping unnecessary and unwanted "junk" mail from being sent.

Materials:

* Paper
* Pencils
* Envelopes

Method:

Students will (with the approval of their parents) write a letter to stop junk mail from coming to their homes.

Background:

One of the greatest wastes of paper in America is caused by junk mail. The majority of people never even open half the junk mail they receive -- it goes directly into the garbage. Some people recycle their junk mail along with other recyclable paper. But the best solution is to stop the junk mail before it reaches the mailbox. This can be done by simply having your name removed from the master list that is sold to companies who send mass mailings. It will not stop all junk mail from being sent, but it will cut it back by about seventy-five percent. The amount of junk mail sent to Americans every year amounts to the loss of about 100,000,000 trees!

Suggested Procedure:

1. Have the students each write a letter asking to have their family names (list all family members) removed from the master list that is sold to companies who send mass mailings. The students can take their letters home and ask their parents to sign them, as long as they approve. Then the students can mail the letters. Each student can address the envelope including their return address, to:

   Mail Preference Service, Direct Marketing Association
   11 West 42nd Street
   P.O. Box 3861
   New York, NY 10163-3861

MAKE A BAROMETER

Subject: Weather
Duration: 1/2 hour
Location: Classroom
Related Activities: Weather Changes

Objectives:

To make a barometer for use in measuring changes in air pressure.

Method:

Following the step-by-step directions, build a barometer for use in the classroom weather station.

Materials:

* Mason jar
* Large balloon
* Rubber band
* Straw
* Glue
* Paper
* Pencil

Background:

A barometer is used to measure changes in air pressure. Knowing whether air pressure is rising or falling helps to predict future weather conditions. A rising barometer often indicates that fair weather is coming, whereas a falling barometer usually means a storm is on its way.

Suggested Procedure:

1. Build a simple barometer using the above materials and the following directions:

   - Cut a large piece of balloon to cover the mouth of the jar.
   - Stretch the piece of the balloon over the mouth of the jar, and secure it tightly with rubber bands.
   - Glue the drinking straw to the balloon so that it lies horizontally and one end of the straw is positioned directly over the center of the jar opening.
   - Place the barometer so that the straw points toward and nearly touches a wall. On the wall directly in front of the straw, mount a piece of paper.

Suggested Procedure (Con't):

- On a rainy day mark the position of the straw on the paper and write "STORMY." On a fair day mark the position of the straw on the paper and write "FAIR." Check the markings on a couple of days to insure an accurate reading.

- Have the students use the barometer to try and predict the weather.

MAKE A HYGROMETER

Subject: Weather
Duration: 1/2 hour
Location: Classroom
Related Activities: Weather Changes

Objectives:

To build a hygrometer to detect the amount of humidity in the air.

Method:

Make a hygrometer according to the step-by-step directions and use it in the classroom weather station.

Materials:

* Large pine cone
* Drinking straw
* Glue
* Paper
* Pencil
* Small piece of wood
* Thumbtack

Background:

A hygrometer can be used to determine the amount of humidity in the air. Using a pine cone for a detection device, its scales will open or close depending upon the amount of humidity present. Students can use this device to measure the relative amount of humidity -- high, low, or average.

Suggested Procedure:

1. Build a simple hygrometer for use in the classroom weather station using the above materials and the following directions:

   - Dry out the pine cone by keeping it indoors for a few days.
   - Glue a thumbtack onto a board with the point facing up.
   - Glue a straw to one of the scales on the pine cone.
   - Mount the pine cone on the board by pushing the top of it (the part that was once attached to a branch) onto the thumbtack.
   - Place the hygrometer in an area where the straw can point toward and nearly touch a wall. Mount a piece of paper on the wall directly in front of the straw.

Suggested Procedure (Con't):

- Mark the places on the wall where the straw points during times of varying humidity. A foggy day will have 100% humidity, a fairly humid day measures 80-90%, and a low humidity day is 80%. Label the marks as high, medium, and low.

Note: If the classroom air is dehumidified, the hygrometer may have to be set up outside.

MAKE A RAIN GAUGE

Subject: Weather
Duration: 1/2 hour
Location: Classroom
Related Activities: Weather Changes

Objectives:

To build a rain gauge to determine the amount of precipitation that falls.

Method:

Make a rain gauge according to the step-by-step directions and use it in the classroom weather station.

Materials:

* Clear cylindrical tube made of plastic
* Ruler (or yardstick)
* Piece of wood
* Glue
* Tape
* Grease pencil

Background:

A rain gauge can be used to determine the amount of precipitation that falls during a certain time span. The gauge is read by determining the total rainfall, and subtracting the previous amounts of rainfall that have accumulated in the tube. During a single storm, the amount of rain may vary from an inch or less to many inches.

Suggested Procedure:

1. Build a rain gauge for use in the classroom weather station using the above materials and the following directions:

   - Obtain a cylinder of waterproof material that is at least a foot in length and approximately two inches in diameter. Glue the base of the cylinder to the piece of wood, and allow sufficient time for it to dry.

   - Tape a ruler or a yardstick to the side of the cylinder for measurement purposes, or make marks every half inch on the cylinder with the grease pencil.

   - Place the rain gauge outside in an area where it will catch the precipitation that falls. (Do not place it under an awning.)

Suggested Procedure (Con't):

- Each day that the gauge is checked, record the amount of rainfall since the last reading and make a mark with the grease pencil at the current level.

WHICH WAY DOES THE WIND BLOW?

Subject: Weather
Duration: 1/2 hour
Location: Classroom and Outdoors
Related Activities: Weather Changes

Objectives:

To build a wind gauge to determine the direction of the wind.

Method:

Make a wind gauge according to the step-by-step directions and use it in the classroom weather station.

Materials:

* Compass
* Long piece of wood or stick
* Thumbtacks
* Piece of ribbon
* 4 small sticks

Background:

A wind gauge can be used to determine the direction the wind is blowing. Winds are named for the directions from which they blow -- in other words, a north wind comes from the north and blows toward the south. It is useful to know wind direction when trying to predict the weather. A sudden change in the wind's direction can indicate that a change in weather is approaching. Winds from the east often bring rain, winds from the west can bring fair weather, winds from the north are often cold, while winds from the south are warm. A sudden shift to a south or east wind often means a storm is approaching, while a shift to a north or west wind may indicate clearing.

Suggested Procedure:

1. Build a wind gauge for use in the classroom weather station using the above materials and the following directions:

   - To a piece of wood about two feet long by one or two inches wide, attach a ribbon about one foot long by an inch wide. Fix one end of the ribbon to one end of the wood using one or two thumbtacks.

   - Bring the class outside, and using the compass, have the students notice what direction North, East, South, and West are.

Suggested Procedure (Con't):

- Find an area that won't be disturbed, and have a student stand in the center of it. The student will hold the compass, and the four directions (North, East, South, and West) can be marked off by pushing sticks into the ground. Put a tag of some type on the northern marker for reference.

2. Take a wind direction reading by having a student stand in the circle, holding the wind gauge so that the wooden part is vertical and the ribbon trails down from the top. Determine the direction the ribbon is blowing. The wind is coming from the opposite direction.

GLOSSARY

adaptation a feature -- such as a long bill or a sturdy stem, or a behavior -- that helps a plant or animal survive.

amphibian a vertebrate animal with smooth slimy skin that spends all or part of its life in water.

amphipod a type of crustacean, eg. beach hoppers and sand fleas.

anole a common lizard of the southeastern United States that has the ability to change color. It is sometimes called (incorrectly) a chameleon.

arthropods a large group of animals which have jointed legs, segmented bodies, and exoskeletons made of chitin. It includes insects, spiders, and crustaceans.

artillery large guns such as cannons and mortars.

bacteria minute unicellular organisms that are usually parasites or saprophytes, and are the primary organisms responsible for decay and fermentation.

barrier island an island that prevents ocean waves from striking a shoreline. Along the Gulf Coast these islands are usually long, narrow, and composed of sand and plants.

bay an indentation of a coastline in which the water is calmer that in the open sea. It is connected on one side to the sea.

bittern a type of marsh bird with long legs that is extremely secretive. It is closely related to the herons.

black skimmer a black-and-white, gull-like bird that feeds by skimming the lower half of its bill through the water.

blowhole the breathing hole of a whale.

blue crab a type of swimming crab, blue in color, found along the Gulf and Atlantic coasts.

camouflage a color pattern that helps an animal to blend in with its environment.

cape the outermost point of an area of land extending into the ocean.

carbon dioxide a gas, found in the air, that is exhaled by animals and produced by burning organic fuels.

carnivore an animal (or sometimes a plant) that eats other animals.

GLOSSARY

cartilage a flexible but sturdy material that forms the skeletons of sharks, rays, and skates.

caterpillar an early stage in the life of a butterfly or moth.

chitin a hard material that makes up the outer shells (exoskeletons) of arthropods -- eg. crabs and shrimp.

chlorophyll a substance, green in color, that plants use to collect energy from the sun.

clapper rail a common, vaguely chicken-like bird with a long bill, that lives in the salt marsh year-round.

comb jelly a small jelly-like marine animal that is not a true jellyfish -- it is a ctenophore -- almost all comb jellies cannot sting.

conservation using natural resources so that waste is avoided and resources are preserved for future use.

consumer an organism that gets energy by consuming other organisms.

continental shelf an area of shallow seas surrounding a large land mass.

coquina clam a small mollusk that lives in the sand of the intertidal zone.

cove a small indentation in a coastline.

crepuscular refers to animals that come out at dawn and at dusk.

crustaceans ten-legged animals with four antennae and a hard outer shell (exoskeleton) -- eg. shrimp, crabs, lobsters.

cumulus a low puffy cloud with a flat bottom.

decomposer an organism that breaks down dead plants and animals.

detritus dead and decomposing plants and animals.

diversity variety.

egret a type of wading bird with a long neck, long legs, and a spear-like bill -- closely related to herons. Great egrets, snowy egrets, and reddish egrets are found along the Gulf Coast.

endangered rare and in danger of extinction.

GLOSSARY

environment the place where an organism lives.

erosion the wearing away of rock, soil, or sand by wind, water, chemicals, or human disturbance.

evaporate when a liquid becomes a gas.

exoskeleton the hard outer shell of an invertebrate -- an external skeleton.

extinct no longer alive anywhere.

fiddler crab a common salt marsh crab that lives in burrows. The males have one small and one enlarged claw, while females have two small, equally-sized claws.

food pyramid a diagram, triangular in shape, that shows how a small number of consumers, positioned at the top of the triangle, are supported by a greater number of consumers and producers at the lower levels.

food chain the passage of energy from producers (plants) to herbivores (who eat plants) to carnivores (who eat herbivores).

food web the complex, overlapping connections between living things in an environment -- a combination of many interlocking food chains.

forest a habitat dominated by trees.

freshwater marsh a wetland where the dominant plants are soft-stemmed (grasses, etc.) and the groundwater is fresh.

fry newly-hatched fish.

fungi mushrooms and their relatives.

gar a predatory fish with a long, toothy snout.

ghost crabs a type of crab that is white in color, mostly active at night, and lives in burrows it makes in the sand.

gill a structure that extracts oxygen from water.

glass lizard a legless lizard that, unlike any snake, has moveable eyelids and external ear openings.

grass shrimp a small, clear-bodied shrimp that lives in salt marshes, where it clings to the stems of grasses.

grass beds a fragile and extremely important underwater habitat where grasses grow.

gulf a large arm of the sea surrounded by land but connected at one point to the open ocean.

habitat the place where a living thing finds the food, water, and shelter necessary for its survival.

herbaceous plants plants with soft stems that die back in the winter, e.g. grasses, rushes, etc.

herbivore an animal that eats plants.

hermit crab a type of arthropod, but not a true crab. It lacks the hard exoskeleton that other crabs have and therefore inhabits empty shells of other creatures for protection.

heron a wading bird with a long pointed bill and long legs. Along the Gulf Coast there are many species including great blue heron, green-backed heron (also called green heron), and tricolored heron (also called Louisiana heron).

hibernate to pass the winter with a lowered body temperature, reduced heartbeat and respiration.

horseshoe crab a harmless crab-like animal that belongs to an ancient group of marine creatures called merostomates. It is not a true crab.

insectivore an animal that eats insects.

intertidal zone the area of a beach that lies between the high tide line and the low tide line.

invertebrate an animal with no backbone.

larva a young animal that has not yet metamorphosed into its adult form (plural larvae).

least tern a small seabird with pointed wings, related to the gulls. In many parts of the United States it is endangered.

lichen the combination of a fungus and an algae.

life cycle the development of a living thing from birth to adulthood to reproduction to death.

littoral current a current of water that runs along a shoreline.

mammal a warm-blooded vertebrate, covered with fur, that nurses its young.

mandible the upper or lower part of a bird's bill or beak. Some other animals also have mandibles.

metamorphic rock a rock that has had its structure changed by heat and pressure.

metamorphosis a change in shape that an animal undergoes as it develops from egg to adulthood. An example is when a caterpillar is transformed into a butterfly.

migration regular movement between a winter habitat and a summer habitat.

mole crab a type of crab that burrows in the swash zone of sandy beaches.

mollusks a group of invertebrate animals that includes gastropods, bivalves, and cephalopods. Some members are snails, clams, oysters, scallops, squid, and octopi.

moon jelly a type of jellyfish that is umbrella-shaped with the pattern of a four-leaf clover on the top of it. It produces a mild venom and can cause a burning sensation if touched.

mullet a common fish of coastal waters that feeds mainly by straining decaying organic matter and plankton from the water.

needle rush a common, salt-tolerant, needle-like plant that grows in salt marshes. It is also called black needle rush or juncus roemerianus.

nocturnal night-active.

nudibranch a type of marine animal (a gastropod with an internal shell), also called a sea slug.

omnivore an animal that eats both plants and animals.

osmosis the process by which a fluid moves through a membrane from one solution to another in order to equalize the concentrations of the two solutions.

osprey a large, fish-eating hawk. It was almost exterminated by the use of the pesticide DDT.

overfishing the taking of so many fish from a body of water that the fish populations decline.

parasite an organism that lives on or in another organism and harms its host in the process.

peninsula an area of land that projects into a body of water.

periwinkle a common snail that lives in salt marshes.

pesticide a poison used to kill an animal that is considered to be a pest.

photosynthesis the process by which plants use chlorophyll and energy from the sun to make food (sugars) from carbon dioxide and water.

phytoplankton plant plankton.

pitcher plant a carnivorous plant that catches and devours insects using its pitcher-shaped leaves.

plankton plants and animals that live in the water and have limited or no swimming ability. They are usually microscopic but they can be larger (such as eggs, jellyfish, or the ocean sunfish).

plover a type of shorebird, related to the sandpiper. There are numerous species.

pollination when pollen is moved from male to female flower parts, beginning the process of seed formation.

polychaete worm a segmented worm that lives in the sand of the intertidal zone.

predator an animal that hunts, kills, and eats other animals.

prey an animal that is hunted for food.

producer a green plant that is able to produce its own food via photosynthesis.

radula the abrasive mouthpart of a mollusk used for scraping and chewing.

salinity a measure of the salt content of water.

salt marsh a wetland where the dominant plants are soft-stemmed (grasses, etc.) and the groundwater is salty.

sand dollar a marine animal with a round hard body that resembles a silver dollar.

sandpiper a common type of bird in the group of shorebirds, usually small, that feeds along the water's edge. There are numerous species.

scavenger an animal that eats dead plants and animals.

sea oats — a tall grass with showy, oat-like seeds that lives in sandy soil. Its ever-growing root system helps to hold sand dunes together.

sound — a calm, protected body of salt water connected to the sea at at least two points.

spartina — a salt-tolerant grass that thrives in coastal marshes. It is also called salt marsh cordgrass or spartina alterniflora.

species — a particular type of organism that is different from any other organism in some way.

stewardship — taking care of something, such as a specific habitat or environment.

swamp — a wetland where the dominant plants are woody-stemmed (trees and shrubs). The water may be fresh or salty.

swash zone — the area of a beach that is regularly doused by the surf. It is also called the surf zone.

thermoregulation — the process by which animals control their body temperature.

vertebrate — an animal with a backbone.

water cycle — the process by which rain falls, fills oceans, lakes, and rivers, evaporates, condenses to form clouds, and falls again as rain.

woody plants — plants with sturdy stems that persist through the winter, e.g. trees, shrubs, etc.

zooplankton — animal plankton.

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